SCIENTIFIC AMERICAN

THE NEW LAURENTI SUBMARINE SALVAGE BOAT AND TESTING DOCK.—[See page 430.]

Vol. CXII. No. 19
May 8, 1915

Munn & Co., Inc., Publishers
New York, N. Y.

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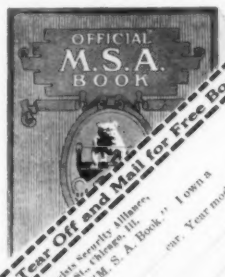

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SEVENTY-FIRST YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CXII. NUMBER 19.] NEW YORK, MAY 8, 1915 [10 CENTS A COPY $3.00 A YEAR

Hand Grenades

By Edward C. Crossman

BACK in the days of the muzzle-loading musket used by the armies of the world, it was not surprising to find the hand grenade in common use. With the gun as slow to load as a modern coast defense gun of largest size, of little power, inaccurate, and used in a manner that deprived it of half its possible usefulness, the hand grenade was an instrument that compared quite favorably with the musket for making the gentlemen on the other side of the argument as uncomfortable as possible.

In those days the hand grenade was merely a hollow iron shell, with a fuse that the grenadier lit from his always glowing match, and then lofted into the assemblage of the persons not agreeing with his government. Sometimes it was nicely timed, and when so timed it left a considerable gap in its immediate neighborhood. At other times its targets snuffed out its fuse, or else picked it up and hove it back to its senders, which was manifestly not playing the game fair. Inside the shell, of course, reposed a quarter or half pound of black powder, which is quite sufficient to distribute jagged bits of cast iron casing with considerable celerity.

In these days, however, of rifles sighted up to 2,500 yards, and having the extreme range of 2½ miles; of clip loading magazines that enable an accurate and sustained fire of twenty-five or thirty shots a minute; of machine guns that chatter forth shots at the speed of an agitated pneumatic riveter on a steel framed building, and of long-range field guns, the mere mention of a hand grenade is sufficient to provoke snickers among the listeners. The British "Musketry Regulations," containing a grave discussion of the hand grenade and how it is to be used, was as funny as *Puck* or *Judge* to those reading it, and not believing in the possibility that 2½-mile rifles could be brought down to the dull level of trench fighting at 50 yards range.

Now with the war nine months gone, and the trenches of the Allies and their German friends hobnobbing with each other at the distance of 50 yards or so, students of warfare have made some astonishing discoveries. One of them is that while a rifle of 2½-mile range won't hit a man with his head snugly down in a pit 50 yards away, a missile cannily lofted across the intervening space into the pit, may do with the aid of gravity just what the bullet failed to do because of its failure to respond early in the game to the blandishments of the gravity siren.

The Teutons, with their usual love for thoroughness, evolved a short-barreled exaggerated howitzer of range *nil*, but of propelling power considerable. All they ask of this little gun is to heave a few hundredweight of high explosives into the air far enough for them to fall into the trenches of the other fellows a couple of hundred yards away, or even less. Here is the old hand grenade again, but of heavier weight, and with a little powder to do what the husky arm of the old grenadier used to do.

Also the true hand grenade is come into its own once more. If the belligerents keep on, we'll see the Germans advancing in Macedonian phalanx formation, and the Allies hastening out to meet them disguised as old-time Roman legions. The poor flat trajectory rifle has to hang its diminished head and confess that its very flatness of flight prevents it from curving gently over the edge of the other gentleman's home in the ground and seeking him out.

The British hand grenade, a large number of which they had in service when the war broke out, consists first of a piece of cane with a metal head on it, containing the bursting charge of lyddite, and the detonator or exploding arrangement to act when the grenade strikes. The handle and head are 16 inches long over all. Attached to the end of the cane handle is a 3-foot bit of cloth, the tail, to make the grenade fly true and insure that it strikes head first, on its detonator, after which the cute little affair takes care of itself and those around it.

The grenade, with its detonator and its safety devices to prevent premature discharge in carrying it, form quite a complicated and expensive bit of machinery.

Normally the machine is carried by a hook, handle downward, at the soldier's belt. When the time seems ripe to transfer its affections to the other fellows, the soldier unhooks it from his belt, turns a cap at the head of the grenade until the word "remove," painted on the cap, is exposed and in line with arrows on the body of the grenade and then removes the safety cap. Then the detonator is placed into position on the side of the grenade and given a turn to lock into position in the studs provided for it.

The tail is then unwound from the handle, the cap is replaced and turned to fire position, the safety pin locking the detonator plunger is withdrawn, and the machine is ready to throw.

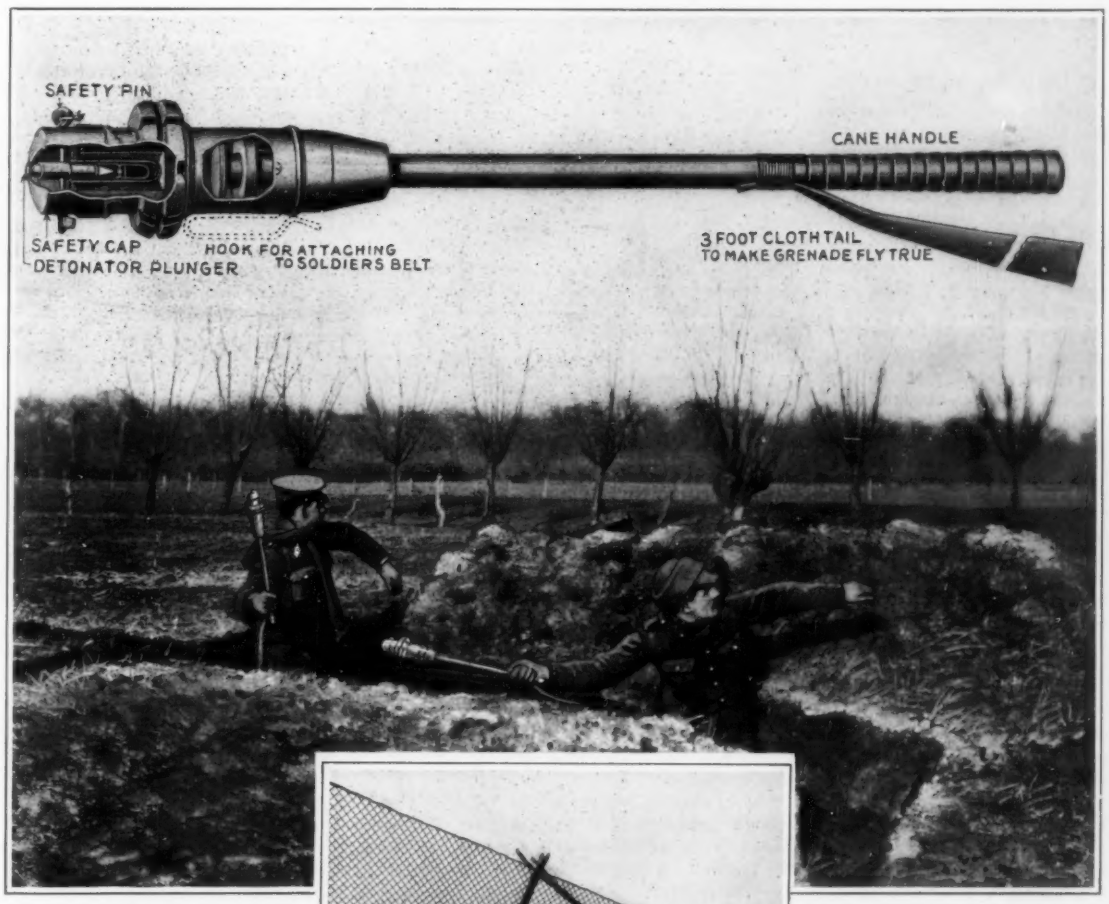
The soldier is instructed to throw it at an angle of not less than 35 degrees with the ground, both to give it the required range and to insure the machine hitting on its head and firing from the impact. It may be thrown under or over-handed. The soldier is told to be sure that the 3-foot tail does not become entangled with him or any other object as it leaves his hand.

In actual service the machine is always ready for service, unwinding the tail, withdrawing the safety pin, and turning the cap to "Fire," being all that is necessary.

The bursting charge of lyddite is sufficient to blow the steel head into bits and kill the men standing close by it. The explosive is similar in its action to guncotton, but is made of carbolic acid and nitric acid, being of a form of the better known picric acid. The French melinite and the Japanese shimose are similar explosives under another name.

The grenade differs from the old type in that it is fitted up with percussion cap or detonator, sensitive to shock, to explode on impact with anything after it is set to "Fire," while the bursting charge, due to the great improvement in explosives, is five or six times as powerful, weight for weight, as the old-fashioned black powder formerly universally used in missiles of this character.

The trench fighting in Belgium and northern France has shown the full effectiveness of these miniature bombs, and it is not unlikely that the soldiers of Uncle Sam may find themselves drilling now and then in the gentle art of heaving an infernal machine full of high explosives across a few yards of ground, instead of learning how to hit things at 1,000 yards with the out-of-date rifle.



Practising throwing hand grenades into the enemy's trenches.

Net protection against hand grenades.

SCIENTIFIC AMERICAN

Founded 1845

NEW YORK, SATURDAY, MAY 8, 1915

Published by Munn & Co., Incorporated. Charles Allen Munn, President; Frederick Converse Beach, Secretary; Orson D. Munn, Treasurer; all at 233 Broadway, New York

Entered at the Post Office of New York, N. Y., as Second Class Matter
Entere l as Second Class Matter at the Post Office Department, Canada.

Subscription Rates

Subscription one year	$5.00
Postage prepaid in United States and possessions. Mexico, Cuba, and Panama	
Subscriptions for Foreign Countries, one year, postage prepaid.	4.50
Subscriptions for Canada, one year, postage prepaid	5.75

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Scientific American Supplement established 1876. " "	5.00
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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp* the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Strategic Positions of the Contending Armies

IN analyzing the situation in a given theater of military operations as to the opportunities offered to armies of occupation, the first step must be to determine all the strategic possibilities, and then to eliminate those that, for one reason or another, cannot be applied to the particular case at hand. To apply this principle to the situation as it exists on the western front of the war in Europe, these conclusions must inevitably be reached:

First, that inasmuch as one flank of each army rests on the North Sea and the other on the Swiss frontier, a general flanking operation by either belligerent is impossible; second, as the country in rear of both the German and the Allies' lines is liberally checkered with both railroad lines and excellent state roads, no general movement against lines of communication or supply can be undertaken. This restricts the number of possible moves that can affect the general line to but one, a flanking operation, against a given section of the existing line, preceded by a frontal attack of sufficient power to break through. In other words, it must be a hacking operation, followed by a movement against the flank of the broken line at the point of rupture. Local successes attained through operations against a supply line are possible, and will result in a retirement of small sections of the line, as, for instance, a successful move against the Metz-Thiaucourt Railroad in the Woevre district. The cutting of this road would compel the German line from Etain to St. Mihiel and thence to Pont-a-Mousson to fall back on Metz so that from Etain the line would run east to Metz and thence south along the Lorraine border. The general effect of such a move would be practically *nil*. The Germans would occupy a hundred square miles less of French territory, but their new line with Metz in the center would be stronger than the old.

All the fighting that has taken place this spring in the northern section of the line from Armentières to Dixmude has had for its object an ultimate flanking move. St. Eloi, Neuve Chapelle, and Hill No. 60, east of Lillebeke, were all fought for the purpose of bending back the German line at these points, and, by increasing the pressure, to force the German right wing, in order to straighten out their line, to fall back to some point on the North Sea west of Ostend. The general plan followed in each case was the same. A large concentration of men and guns was made at the true point of attack. An attack was then launched against some other point. When the line in front of the true objective was weakened to reinforce the point of attack, the real attack was driven home. The present German advance along the Ypres Canal, in its final analysis is likewise a flanking move. The object to be accomplished is, first, to force the retirement of the British from Ypres, which is the key to the Yser district, and then the withdrawal of the entire left flank from Belgium, thus opening the way to Calais and the consequent command of the Straits of Dover. This move is the most important that has yet been made in the western theater since, if successful, it will be most fruitful of results. It is therefore of interest to study the conditions that will bear directly on its success or failure.

During the winter Germany has increased her field force by about five hundred thousand men. This brings her to the point of maximum strength. The losses that are now being sustained and that will be sustained as the fighting progresses cannot be replaced. Germany, as well as the Allies, is short of ammunition, and therefore for months, instead of taking the offensive, has remained on the defense and so conserved her supply until all was considered in readiness for her strong offensive effort. Many of this last levy of troops have been brought up to the Ypres-Dixmude lines and are now engaged, so there is but a small reserve on which to fall back. Germany, therefore, must succeed in the present battle or acknowledge herself unable to maintain a sustained successful offense against the Allies' line. The result must be a return to the defensive status she has occupied up to the beginning of the battle of Ypres. Her offensive power will be permanently impaired, if not destroyed. In such a contingency Germany's only hope of averting defeat will be to play for a stalemate. An army that cannot deliver a strong attack cannot know victory.

On the other hand, Germany's organization and the consequent control by her commanders of all grades over the men in the ranks is undoubtedly developed to a finer point than is the case with the Allies. This is illustrated by the difference in the result accomplished when their opponent's line has been broken. At Neuve Chapelle, St. Eloi, and Lillebeke in the rush forward by the Allies that followed the breaking of the German line, but a comparatively small advance was made beyond the German trenches before all control of the officers over their men had gone and the advance disorganized. In striking contrast was the German advance through the break in the Allies' line at Langemark. This advance was steady, systematic and well organized, and control and contact was never lost. The advance has been temporarily checked, it is true, but by the force of strong reserves brought up by the Allies, not by any inherent fault in the German organization. This is one of the most potent factors in a successful offensive engagement. Without it, the enemy's reserves, held well in hand, striking a force that an advance has disorganized and thrown into confusion, can often turn victory into defeat.

In the eastern theater of operations the situation is somewhat confusing, owing to the contradictory nature of reports issued from the various headquarters. Certain elements of the general situation are, however, known with fair accuracy. There are several separate and distinct battle lines, extending generally in a huge semicircle from the Niemen to the Rumanian frontier, where it is crossed by the Pruth River. The first line, which is involved in the operations around Warsaw, the Mazurian Lakes and East Prussia, extends from the Niemen to the Rawka River. There is then a break, the second line beginning at about the Nida River, the break being spanned by large cavalry patrols. From the Nida the line runs south to the Carpathians and then east along the crests to the Stryj River. The third line runs along the Stryj toward Munkacs. The fourth is along the Pruth, north of Bukowina Province. The only line that is really active is that section running along the ridges of the Carpathians, where the battle for control of the passes has been raging since the fall of Przemysl. Every effort of Russia and the Germanic Allies is concentrated along this line, to the almost complete disregard of the other portions of the eastern theater.

The keynote to the Carpathian battle is Uszok Pass, around which the most terrific battle of the war has been in progress for nearly six weeks. If Russia cannot force the passage of the Carpathians here, the entire Carpathian campaign will be a failure. Russian possession of the railroad is absolutely necessary as a line of supply to her army, as it moves forward down the southern slopes of the mountains toward the plain. But, judging solely on the meagre reports of this section that the censor has permitted to come through, Russia is no nearer her accomplishment than she was several weeks ago.

As matters are now, therefore, on both fronts the end of the war, in so far as it may be concluded by force of arms and not by political or economic considerations, is a long way off. There is but one factor that may hasten its end, and that is Italy's advent into the maelstrom. Italy may well prove to be the balance of power. The invasion of Austria, across the Julian Alps, by a million and a half fresh men, well equipped with artillery and plentifully supplied with ammunition, would eliminate Austria completely from military considerations and, by destroying one of Germany's main sources of supplies outside of her own borders, would do much to bring matters to a conclusion on both fronts. In any event, however, the present indications are that the west will never bring about the war's conclusion. If decided by arms at all, the decision will be made in the eastern theater.

Typhoid Fever

TYPHOID fever has fourth place on American mortality lists, coming after only tuberculosis, pneumonia and cancer. It takes among us the place of the "Asiatic Guest," which the European peoples have from time immemorial so constantly and so unnecessarily entertained. Both these diseases are "ingestion infections" contracted in absolutely no other way than by swallowing food and drink (the latter mostly water or milk) contaminated in various disgusting ways, with either the cholera vibrio or the typhoid bacillus. Dirty fingers and the filthy fly are the chief intermediaries. Scientifically speaking, nothing can be simpler than the prevention of these infections. The application of the principles is, however, of great practical difficulty. For example, there is the cook, Typhoid Mary, a carrier of the germ, who, although she declared she never herself had the disease, has, nevertheless, in those migrations from family to family peculiar to her caste, through a number of years disseminated the infection to some score or more of sufferers. There have indeed been typhoid carriers who have had the disease forty years previously and have continued through all that time being a menace. It is computed that one fourth of the people who have had typhoid are carriers; that, disease or no disease, one in every one thousand of us is such a carrier. Most infections are self-limited; their quarantining time is fixed. But you cannot quarantine a typhoid carrier a whole life time, any more than you can frame an indictment against a whole nation. The great trouble with Typhoid Mary has been her perversity, exceeding even that which obtains in her most temperamental of callings. She has never conceded herself a menace; she has not obeyed the sanitary directions given her; she would not wash and disinfect her hands as required; she will not change her occupation for one in which she will not endanger the lives of others; under an assumed name she had competed with the Wandering Jew in scattering destruction in her path. Typhoid carriers who are amenable to reason, conscientious, careful and scrupulously clean, need not endanger anybody's existence.

However, the American people have surmounted difficulties a thousandfold greater than any typhoid fever presents. The elimination of this infection depends largely on the fact that the individual cannot protect himself without the aid of the constituted authorities. Typhoid disappears most surely in that community where such authorities know their business and are determined to go about it until they have accomplished it. And the better the citizen body hold up their hands, the quicker and the more thoroughly the beneficent job gets done.

The best insurance against typhoid is, after all, to get inoculated against the disease, as all sensible people are now vaccinated against small-pox. Especially is this well to do when there are typhoid epidemics; and for commercial travelers, motorists, tourists and vacationists who may in the most subterranean ways contract typhoid and become typhoid carriers. And since this is a disease largely of adolescence, youth and early manhood and womanhood, our young people going to boarding schools and colleges should certainly submit to this preventive measure before leaving home. It is considered that the protection is effective for at least two years, and may indeed immunize for life. When the inoculations are made in the afternoon untoward sensations are likely to have disappeared by the following noon. A series of three successive inoculations are made a week apart. Deaths have been alleged to be due to such inoculations; but in every such case the death has been found by the authorities, on autopsy, to have been due, not at all to the inoculations, but to some disease in no wise related to or affected by this anti-typhoid preventive measure.

Radium and Cancer

EUROPE, where the popular furor about radium and its applications appeared earlier than it did here, has already been devastated by the appearance of great numbers of dishonest and fake, money-getting, radium-cure establishments conducted by persons who possess little or no radium, and have no knowledge of its use. These people promise cures, but are, in reality, unable to obtain even those palliative effects which are possible from radium. Much harm has also been done there by honest and educated enthusiasts, who have been led to premature confidence in the curative effects of radium by the excitement of witnessing the temporary relief of symptoms and decrease of tangible tumors which it undoubtedly produces even in advanced cases. Statistical evidence to support the advice and warning to seek early operative treatment has been collected by Mr. Frederick L. Hoffman, statistician of the Prudential Insurance Company of America. According to Mr. Hoffman the recorded experience of the best hospitals goes to show that earliest possible operation for cancer seems to offer the only hope for cure. These records are distinctly encouraging, and prove that at least the initial loss of life in such operations is very low.

Science

A Manual of the Flora of Washington, D. C., and Vicinity is being prepared by a number of Washington botanists, under the direction of Messrs. Hitchcock and Coville, of the U. S. Department of Agriculture. It is expected that a preliminary edition, to include the flowering plants and ferns, will be published in the spring of 1916, and it is hoped that later editions will include all cryptograms.

Leffingwell's Explorations in Alaska.—According to the *Bulletin* of the American Geographical Society, Mr. Ernest de K. Leffingwell has completed the extensive explorations and surveys of the northern coast on which he has been engaged for some years, and is now preparing his results for publication. He has mapped about 150 miles of the coast, including many islands, on a large scale, besides making soundings in the adjacent waters and mapping the broader geographical and geological features over an inland area of about 80 square miles.

The Yangtze-kiang.—Some estimates of the discharge of this great river and of the amount of sediment it carries have recently been published by Prof. Konrad Keilhack, of the Berlin School of Mines, who visited the river in September, 1913, when the stage of water was unusually high. From measurements of depth made at Wusung, Nanking, and Hankow, and estimates of width and velocity, this authority concludes that the discharge below Hankow (685 miles from the mouth) amounts in time of flood to 3,500,000 cubic feet per second. The annual mean is estimated at 1,750,000 cubic feet per second. Filtration measurements made at the mouth, near Wusung, taken in conjunction with the above figures for discharge, indicate an annual transport of sediment at the average rate of 37,500 pounds per second, or a total of 584,000,000 tons per annum.

Banana Juice for Snake-venom Poisoning.—The latest alleged remedy for snake-venom poisoning is banana juice, according to F. W. Fitzsimons, who records in the *South African Journal of Science* that within a year past he has received cuttings from newspapers and magazines on this subject from every snake-infested country of the world. Already companies have been formed with a view to extracting the juice from the banana stem and placing it on the market as a sure cure for snake-bite. In view of the marvelous cures reported, Mr. Fitzsimons conducted a series of experiments on animals of various species, in each case injecting the venom of a cobra, puff-adder, or other deadly serpent, and administering a copious dose of the alleged antidote—before, after or simultaneously with the poison. The juice of the plantain variety of banana was also tried. No antidotal effect whatever was obtained. The author explains that in the cases reported as cures sufficient venom had not been injected to cause death, and the patient would have recovered as quickly without treatment. It is a common occurrence for large poisonous snakes to deliver a full bite and not shed sufficient venom to cause the death of even so highly susceptible a creature as a fowl. Moreover, a snake will sometimes bite at the leg of an animal or man and miss its aim, and its venom will be shed harmlessly upon the ground; then perhaps in a second or two it will strike again, this time driving its fangs home, but injecting either no venom or too little to produce fatal results. About 60 per cent of the victims of bites by venomous snakes recover without the aid of any treatment.

Fossil Bacteria Discovered.—Marvelous as were the discoveries of such pre-historic monsters as the Mammoth, the Mastodon, and the Stegosaurus, they are now eclipsed by recent investigations which show the most minute microbes and bacteria in fossil form. The ancestors of our modern infectious disease germs and microbes have been found in fossils of the earliest life on the earth. Fossil bacteria have been discovered in very ancient limestones collected by Dr. Charles D. Walcott, secretary of the Smithsonian Institution, in Gallatin County, Montana. For some time Dr. Walcott has believed that these bacteria existed, and mention of the fact was made before the Botanical Society of Washington on April 6th, 1915, when attention was called to their existence in association with fossil algal deposits of the Newland limestone. The belief that bacteria were the most important factor in the deposition of these ancient limestones was also mentioned by Dr. Walcott in a preliminary publication of the Smithsonian Institution. At that time, however, no definite bacteria had been discovered, but in thin sections of limestone from the collections made in 1914 the microscope now shows these very minute forms of life, some 20 to 30 million of years old. The bacteria were discovered in three sections cut from an algal form included under the generic name Gallatinia, named after the great American explorer Gallatin. The bacteria consists of individual cells and apparent chains of cells which correspond in their physical appearance with the cells of Micrococci, a form of bacteria of to-day. The world has believed that bacteria were modern forms of life but now we are made to realize that they existed in the dawn of world history, many million years ago.

Automobile

Keeping Car Cushions Cool.—William A. Daniels, of Dermott, Ark., in a patent No. 1,135,161 provides at the rear end of an automobile brackets for a spring curtain roller, the shade of which can be drawn forward whenever desired and secured at the front end of the car so the cushions of the car will be protected from the sun when the machine is standing empty with the top down.

Combined Automobile Signals.—In a patent No. 1,135,048 A. N. Pierman of Newark, N. J., combines with an ordinary rubber bulb horn an electrically operated signal device whose circuit closure is operated within the bulb, the two parts being so constructed that when in city traffic the reed or bulb horn can be operated, while the electrically operated horn may be brought into play for use in the open country.

Combination Lock for Trunks.—A simple and effective combination lock for trunks or automobile boxes consists of the usual hasp lock having below it a small button carrying figures for the combination. On the plate are two imitation rivet heads spaced at each side of the main button, but one of these heads is movable. To open the lock, the combination is turned, then the left-hand rivet-head is slid to one side, and this action causes the lock to open. The combination button is of solid make-up in itself, and is further protected by the projecting rivet heads on each side. Such a device affords 1,000 combinations, and is the subject of a French patent.

Motorcycle Batteries in War.—The present war in Europe is the first opportunity which motorcycles have had to show their worth as light artillery. A British machine gun battery is composed of a touring car for the commanding officer, two motorcycles with sidecars, on which Vickers light machine guns are mounted; two reserve machines, which are fitted with all the necessary arrangements to have guns mounted on them, and two sidecars loaded with ammunition. In addition to the six motorcycles, there are usually three large touring cars, loaded with additional ammunition, rifles, provisions and equipment. The battery is accompanied by a lieutenant on a very fast racing motorcycle.

Safety Tire Valves.—Among the things "not to be invented" should be listed so-called "safety tire valves," which are designed to permit only a maximum pressure of, say, 75 pounds, at which the valve opens enough to let a certain quantity of air in the tire escape. Tire experts call attention to the fact that if a car is left standing for a couple of hours, as often happens, with one or more tires in the direct glare of the sun, the pressure in these tires, due to the heat is liable to rise far beyond the "danger point." If the tire valve opens at this time, and the sun sinks beyond the house tops later on, permitting the tire to cool off thoroughly, the tire is more likely to be run insufficiently inflated.

Heavy Trucks and Bridges.—One of the most gratifying results of the present war excitement in Great Britain is the action of the House of Lords, providing for a general strengthening of the bridges along the main roads of motor traffic. These bridges were mostly under the management of the big railroad companies, and the heavy truck traffic did not appeal to them enough to cause them to expend either money or labor in strengthening the bridges. The heavy traffic in motor trucks for the British War Department has brought the question of strong bridges vividly before the people, and strong pressure is being brought by the courts, officials of the government and the press on the railroads. The result is that bridges are rebuilt all over the country.

Finding Tire Punctures.—An ingenious little device known as "detective" serves to localize punctures in bicycle tires and can even be used on automobile tires. It is no longer required to immerse the air chamber in water, this being often very inconvenient or even impossible to carry out; neither is it necessary to remove the pneumatic tire from the wheel, for the small device is run along the surface until the leak is found. The 'detective" is a small metal box of suitable shape whose under side embraces the tire and here is closed by wire gauze. Radially the box is divided into four or more compartments and in each one is a small amount of very light down which the slightest wind causes to fly up. When brought upon the leak, the pressure of the air acts upon the down, and this localizes the leak at once.

Europe Will Be Flooded With Cars.—American motor cars are to be thrown into Europe, particularly into Germany and France, immediately after the war is ended, in a manner which will make all former American "invasions" pale into insignificance. One of the largest of the automobile companies is known to be preparing to send no less than 10,000 touring cars and roadsters into the German market, within a month after the war is ended. Other companies plan a like invasion, and the export business in American motor cars will be such as simply to swamp the factories. Great Britain already sees the writing on the wall and frantic appeals come from the trade press and the dealers to the large manufacturers, imploring them to try to produce a small, standardized car in large quantities, to sell for about $700 or less.

Astronomy

The Royal Observatory of Belgium, at Uccles, near Brussels, is the most important astronomical institution lying within the "war zone," and, as we have previously recorded, its activities have been partially maintained by its German captors. Its late Belgian director, M. Lecointe, has written a letter to the French Academy of Sciences stating that he is now interned in Holland. He had served in the war as a major of artillery in the Belgian army, and took part in the retreat from Antwerp.

Transit of One Star Over Another.—A note by Prof. Wolf, of the Königstuhl Observatory, describes the rather unusual case of a star which has been carried, by its proper motion, directly over another, as seen from the earth, within the last few years. The eclipsing star is of the 13th magnitude, and has the somewhat rapid proper motion of more than a second of arc per annum. The eclipsed star, of 15th magnitude, was formerly southeast of the other but is now on the opposite side of it.

A New Harvard Photographic Map of the Heavens.—It is announced that Harvard College Observatory will publish a new photographic map of the entire sky, consisting of prints from negatives taken at Cambridge and Arequipa. This set of charts will, in a sense, supplement the set published some years ago, as the center of each plate in the new series will coincide with the corner of a plate in the former one, thus bringing out many faint stars which failed to appear at the corners of the large field (30 degrees square) on account of distortion. The original series comprised 55 plates and showed about 1,683,000 stars, ranging down to the 11.5 magnitude.

A New Spectrum Line was Shown by the Solar Corona, as photographed at certain stations during the eclipse of August 21st, 1914. The Spanish party at Theodosia, in the Crimea, secured a spectrogram on a plate taken 13 seconds after the second contact, with 12 seconds exposure. This shows a new line the computed wavelength of which is 6,378.87 ± 0.036 A. A note in the *Comptes rendus* on the results of the expedition from Meudon Observatory, which had its station at Strömsund, Sweden, states that the plates taken there show a brilliant and intense new radiation in the red part of the spectrum, the measurement in this case being given as 6,374.5 ± 0.2 A.

Lowell Observatory Photographs of Saturn.—Photographs of Saturn taken at the Lowell Observatory on March 12th, both by the director and Mr. E. C. Slipher, confirm visual observations in revealing that Cassini's division is visible in part above the contour of the ball by about four tenths of its true width. This enables the oblateness of Saturn to be deduced from the photographs, a preliminary reduction of which shows that oblateness to be about one ninth. As the required visual observations are of the greatest delicacy and demand for such detections the most favorable conditions, the possibility of making photographs of this order of nicety is an advance both of scientific and general interest.

Comparative Drawings of Mars.—One of the most important contributions that has yet been made to the fascinating question of the Martian canals is Prof. W. H. Pickering's Eighth Report on Mars, published in *Popular Astronomy* for April. Early in the year 1913 it occurred to this astronomer that it might be a good idea at the following opposition to secure from several recognized experts simultaneous and independent drawings of the planet, and to compare these, as one step toward determining just how much may be regarded as definitely known regarding the markings on the Martian surface. More specifically, it appeared desirable to obtain a permanent record of the planet's appearance at the coming opposition, for comparison with similar records in connection with all future oppositions, since it is known that the surface changes from one opposition to another, independently of its seasons. The observers who took part in this programme were Rev. P. E. R. Phillips, Ashtead, Surrey, England; Messrs. Lowell and Slipher, Flagstaff, Ariz.; Prof. A. E. Douglass, Tucson, Ariz., and Prof. Pickering himself, at Mandeville, Jamaica. The drawings, which are published with the report, represent aspects of the planet corresponding to central meridians of 0 deg., 60 deg., 120 deg., 180 deg., 240 deg., and 300 deg. Martian longitude. They are surprising both in their agreements and in their differences. As usual, many more canals were seen at the Lowell observatory than elsewhere. Twenty-four canals were so clearly seen and accurately drawn by the three other observers as to leave no doubt of their being identical in the several drawings. Twenty-one were seen by two observers, and thirty-five by one—apart from the Lowell observations. The drawings reveal an interesting case of shifting canals, Gigas and Tartarus having apparently traveled some 300 miles across country in about three weeks. Prof. Pickering mentions previous cases of shifting canals, including one recorded by Schiaparelli. "Such observations," he remarks, "while perhaps favorable to the idea of intelligent direction upon Mars, do not strengthen the theory of irrigating ditches."

A Mother Ship for Submarines

A Combined Salvage and Drydock Vessel

By Robert G. Skerrett

EIGHT years ago the Fiat-San Giorgio startled the naval world by turning out submarines capable of making fourteen knots an hour on the surface. Since then they have shown engineering initiative in inventing and building a special type of dock designed for the testing of submarines at the surface but simulating all of the hydrostatic conditions incident to deep submergences, thus doing away with the uncertainties characteristic of the ordinary method of testing these boats for water-tightness by lowering them, without anyone aboard to locate leaks, in waters 200 feet deep. The Laurenti dock has already proved its value in Italy.

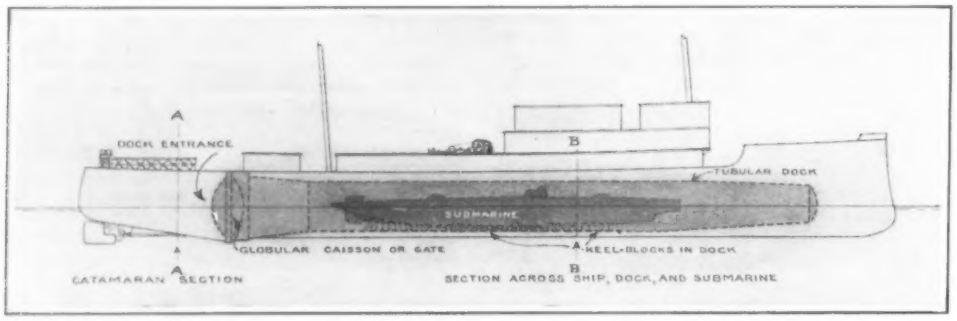


Fig. 1.—Diagrammatic view of ship, showing position of submarine in the testing dock.

Now, the same progressive firm has designed and built an extremely novel mother or station ship for submarines, and again the Italian engineers have blazed the way. This new craft is at once a supply base, a place for the refreshment of the wearied crews of submarines, a repair base, a testing and dry dock, and a speedy salvage vessel capable of raising one of her sunken flotilla and able to carry the injured craft into port. Other nations have salvage ships for submarines, but there their utility commonly ends, and besides, they are clumsy and of very moderate radius of action and speed.

As a basis for this many-sided adjunct to submarine service, the designers planned a mother ship for a flotilla of six submersibles, each of about 370 tons submerged displacement, the idea being that while four of the boats should be actively engaged, two of the group could be held in reserve and made thoroughly fit for relieving their active sister craft. Thus, if occasion required, all six of the submersibles could be sent to sea, but under normal circumstances a third of the force could be undergoing repairs or receiving any other attention which the exigencies of their duties might impose.

The mother ship in question is a craft having a normal seagoing displacement of about 3,000 tons, capable of developing a sustained maximum sea speed of fourteen knots an hour, and at a cruising speed of ten knots an hour carrying sufficient fuel to give her a radius of action of 4,000 miles. The vessel is fitted with twin screws, and each shaft is actuated by a heavy-oil Diesel motor developing something like 1,100 horse-power, these motors using the same fuel as that which she carries in her supply tanks for refilling the fuel chambers of the submarines. Indeed, the idea is that the men qualifying for submarine service shall first learn the management of the mother ship's internal combustion engines by way of a preliminary training, the operation of the motors for the under-water boats being substantially identical.

In order to save the motive mechanisms of the submersibles as far as possible, the mother ship will charge the batteries of the submarines as well as fill their flasks with compressed air, and will hold in reserve enough cells completely to refit two submarines in a few hours. The station ship will have a machine shop and foundry provided with facilities that will make possible all ordinary repairs, and she will carry a large supply of reserve fittings in addition to a store of thirty-six torpedoes. The mother ship has a battery of six powerful rapid-fire guns and should be quite strong enough to hold off a flotilla of destroyers. The mother ship will have a complement of 131 and, in addition, have ample accommodations for 120 men from the submarines. She likewise boasts a commodious sick-bay.

The ship has two hulls, the outer one of homogeneous iron, and the inner and cylindrical hull of high-tensile steel. This inner hull is really a Laurenti testing dock such as the SCIENTIFIC AMERICAN has already described. This tubular structure has an over-all length of 210 feet and a diameter of 23 feet, with available space for the housing, testing, and repairing of a submersible 190 feet long. The forward end of this ship-encased dock is permanently sealed, but the after end is provided with a globular caisson which can be removed and swung aside so as to flood the cylinder and to admit a submarine. The under-water boat reaches this dock entrance from the stern of the mother ship, which at that point is of a catamaran build. The cross-section *A* illustrates this, while section *B* shows the dock farther forward and a submarine resting upon the blocks.

With us, it is customary to subject our submarines to but one deep-water test, and thereafter the Navy Department takes it for granted that the boats will be able to withstand hydrostatic pressure 200 feet under the surface of the sea should accident take them there at any time during their active careers. This does not take into account the structural weakening due to wear and tear. Our submarines should be frequently tested under conditions of deep submergence, but this is impracticable with our existing facilities. But if we had a ship such as we have been describing, one that could be sent from base to base with regularity or reasonable frequency, then all of our submarines could be tested safely and speedily with all of the crew aboard, or with enough observers inside, who could watch for leaks and test valves and pumps and other emergency apparatus under conditions physically duplicating those of deep submergence. In this fashion, any ill effects of time and service could be readily detected and promptly remedied without waiting until the hour of accident to disclose the fatal yielding.

For salvage duty, the mother ship is equipped with a number of powerful windlasses for lifting a sunken submarine. In addition to these, she carries two special boats for diving service and, of course, all of the needful suits and apparatus for the divers themselves. The loss of the "F-4" and the manner in which the salving of that craft has limped should emphasize our own need of a mother ship or mother ships patterned after the sort the Italians have given to the world.

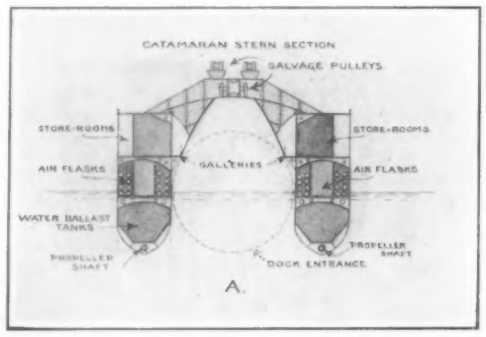


Fig. 2.—Section on AA Fig. 1, showing dock entrance.

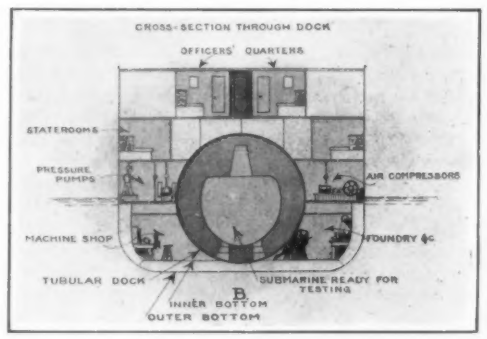


Fig. 3.—Section through dock taken on BB Fig. 1.

War Then and Now

IN the course of a debate in Congress recently, Representative I. R. Sherwood of Ohio took advantage of the opportunity to tell the House of his experiences in the war of the rebellion, and he drew interesting comparisons between the way war was conducted fifty years ago and present practice; but toward the end he apparently forgets the changed conditions that he was discussing. He said:

"I carried a musket that was estimated to kill at 800 yards. I would load that musket by five motions. I carried forty rounds of ammunition, every round done up in brown paper; and the man who passed the examination then as a volunteer had to have a good set of front teeth in order to tear the brown paper from the cartridge. Now, a European soldier can pass an examination if he has no teeth at all. They are now carrying a gun that will shoot to kill at 2,000 yards. That gun will shoot ten times as frequently and is ten times as destructive as the guns the volunteers carried fifty years ago.

"Our field cannon—the largest that we carried—was a 20-pound Parrot gun. Now they are using a gun that will carry for six miles. Our guns were all muzzle-loaders. Now the man who operates a machine gun is behind armor plate; he is protected. Our trenches were thrown up over night. Now they are having trenches built from five to six feet deep, and they are covered with an impervious substance to prevent the havoc of exploding shells. Our armies on both sides were in clear view of each other. Now the armies on both sides are all out of sight, not to be seen.

"Let me call your attention to this fact, that to-day the two armies confronting each other in France and Belgium and the two armies confronting each other on the Russian border have not practically changed their positions for two months. What was the truth about our army in the great civil war? Take the army of Gen. Sherman, whose base of supply was at Louisville, Ky. It fought its way first to Nashville, from Nashville to Chattanooga, from Chattanooga to Rocky Face Mountain, from Rocky Face Mountain to Atlanta, from Atlanta to Savannah, from Savannah up the coast to Raleigh, to the close of the war. How many miles did that army march? Eleven hundred and twenty-five miles. In the Atlanta campaign of 110 days we made an advance of one mile a day—110 miles from Rocky Face Mountain to Atlanta in 110 days.

"Here is another consideration. How many distinguished major generals and brigadier generals have lost their lives in this war? Is there a gentleman on this floor who can name a single brigadier or major general who has been killed in battle in this gigantic European war? They have a line over 100 miles long in the army of the west and over 100 miles long in the army of the east. They have a battle line of over 200 miles, and we read of desperate bayonet charges every day. There cannot be any successful bayonet charges when they carry guns that will kill at a mile, because every column would be annihilated before it reached half a mile. If I were a betting man, which I am not, I would bet my month's salary against a Panama bond that you cannot find five soldiers in any field hospital in France, or Germany, or England, or Russia, or Hungary who are wounded with bayonets. We read of the terrible destruction in these battles. They have fought forty great battles, according to the reports. I venture the assertion that they have not lost 25 per cent of their armies in battle.

"Why, my friends, at the battle of Franklin, where I happened to be just at the right of the Franklin Pike, in a battle line of two and one half miles, twelve Confederate generals were killed or mortally wounded, all on the front line of battle, in five hours' fighting. Do you know of any general being killed while leading a charging column over in this European war? There is quite a characteristic difference therefore between the commanders of our armies in the civil war and of those over across the ocean."

The Occultation of One Jovian Satellite by Another is a somewhat unusual phenomenon. An instance observed November 3d, 1914, at the Observatory of Juvisy is recorded by M. Quénisset in *L'Astronomie*, with pictures of the successive stages. For about 20 minutes the two disks were seen as one.

Measuring Atmospheric Comfort

IT is well known, even in non-scientific circles, that human estimates of temperature often differ markedly from the records of the thermometer, and that this instrument is a rather poor index of atmospheric comfort. The human sensation of temperature depends, to a great extent, upon the rate at which heat is dissipated from the body, and this is regulated not merely by the temperature of the surrounding air, but also by the humidity and the air-movement. Some years ago United States meteorologists introduced the expression "sensible temperature," to denote the temperature felt at the surface of the human body; whether regarded as a subjective phenomenon, which may be estimated according to an arbitrary scale of sensations, or as the actual temperature of the skin, as measured by a thermometer in contact with the latter. In the United States the sensible temperature was at one time regarded as identical with the reading of the wet-bulb thermometer, but this idea has now been discredited.

About ten years ago Mr. W. F. Tyler of the Chinese customs service published extensive observations on the subject of comfort and discomfort under various meteorological conditions and introduced the term "hyther" to denote the combined effect of temperature and humidity. Prof. Cleveland Abbe of the Weather Bureau has also investigated what he calls the "curve of comfort."

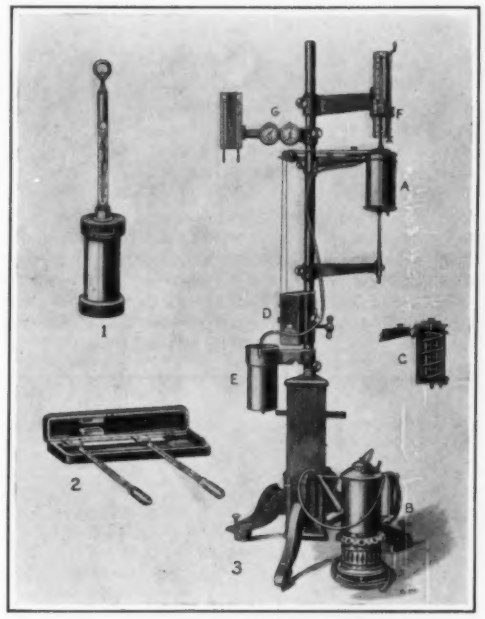
The last annual report of the U. S. Public Health Service records some investigations made under the auspices of that service at the Boston Institute of Technology, in co-operation with the New York State Ventilation Commission, upon the physical factors which influence the dissipation of heat from the body. In this connection an instrument has been devised at the Hygiene Laboratory in Washington for recording the state of atmosphere as it affects this process, which, says the report, "is a complex function of humidity, temperature, and air-movement; and the instrument in question, called the 'comfortimeter,' has for its object the proper balancing of these factors, and the recording of a single index of comfort." The instrument is not yet perfected.

Although not mentioned in the report in question, it is a fact that a large number of instruments for measuring atmospheric comfort have already been devised by various experimenters. One of the most ingenious of these was constructed forty years ago by John W. Osborne of Washington, who described it at the meeting of the American Association for the Advancement of Science in 1875. Osborne also stated the problem of measuring atmospheric comfort, or sensible climate, with a lucidity that has never been surpassed. "The body of a healthy man," he says, "is a mass of hot matter, cooling, and having lost its heat perpetually supplied by physiological changes, in quantity sufficient to maintain a uniform thermal standard of about 98½ deg. Fahr. And, whatever the causes of this loss may be, we say when it is rapid that the weather is cold, and when slow that it is hot. In the one case the functions are called upon to make up the deficiency rapidly, and in the other to facilitate the dispersion of the body's superfluous warmth."

In order to measure the very irregular fluctuations in the dissipation of heat under the influence of varying atmospheric temperature, humidity and wind, from the body, and hence the difficult task performed by the human organism in maintaining a constant internal temperature, Osborne constructed the apparatus shown in Fig. 3. Here *A* is a cylinder of "bond" or bank-note paper, supported by a brass frame. This is filled with hot water from the vessel *B*, while an agitator inside the cylinder (shown separately at *C*), which is kept in motion by clockwork, *D*, mixes the water and keeps its temperature uniform throughout at a given moment. *E* is an overflow attachment. By means of the thermometer, *F*, and a pair of stop watches, *G*, the rate at which heat is lost from the wet surface of the porous paper can be accurately determined. Osborne's observation with this instrument demonstrated the striking differences that often exist between the rate of heat-loss from the cylinder (representing the human body) and the temperature of the air as ordinarily measured.

Quite analogous was the "deperditometer" of A. Piche, which consisted of a porous vessel containing water, the temperature of which was maintained constantly at blood-heat (98.6 deg. Fahr.) by a gas jet provided with an automatic regulator. The amount of gas burned in a given time served as a measure of the cooling power of the atmosphere. The problem was taken up anew by Dr. J. R. Milne, who published in 1911 a description of his awkwardly named "psuchrainometer," which also measures the loss of heat from a surface kept at 98.6 deg. Fahr., but uses electrical heating and measurement.

In the same year (1911) Dr. F. Frankenhäuser published in the *Zeitschrift für Balneologie* an account of an instrument called the "homœtherm" (Fig. 1), for measuring the cooling effects of the atmosphere under different conditions of temperature, moisture, wind, solar radiation, etc. This consists of a small copper cylinder, filled with water, in which is plunged the bulb of a thermometer. The cylinder is heated over a lamp and then exposed in the atmosphere to be tested. The instrument is so constructed that a fall of one degree registered by the thermometer corresponds to a loss of



Measuring atmospheric comfort.

one gramme-calorie of heat per square centimeter of exposed surface. The cylinder may be covered with a cotton jacket, either dry or wet, to represent the clothed human body and the effects of wet clothing. With this instrument Frankenhäuser found that the wind movement accelerated cooling more rapidly than a marked fall in the air temperature. His experiments indicated that temperature is a far less important factor in climate, from a hygienic point of view, than is generally supposed. His apparatus can be arranged for continuous observation, with permanent registering and heating apparatus.

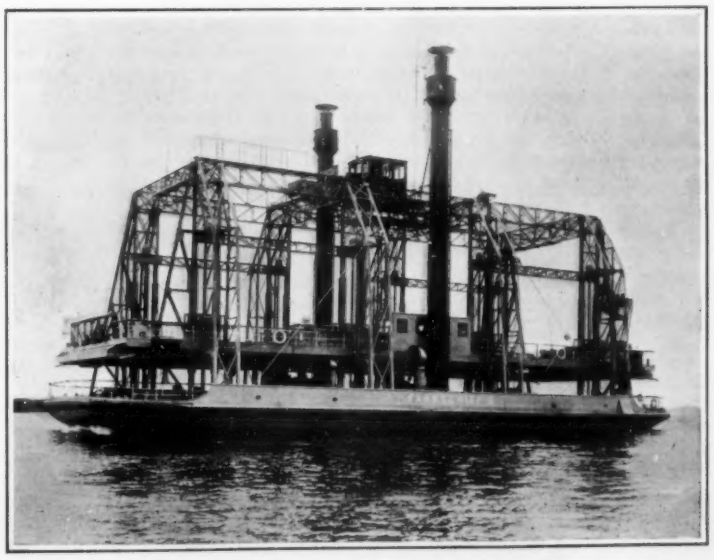
Finally, Prof. Leonard Hill has recently invented two instruments of this class. One, called the "caleometer," which he devised in collaboration with O. W. Griffiths, consists of a small electrical furnace automatically kept at body temperature, and an indicator which shows in calories the energy required to keep it at that temperature. It thus indicates the rate of cooling. Hill's other invention of this class is the "katathermometer" (Fig. 2), which utilizes two large-bulbed thermometers. The bulbs are both warmed to 110 deg. Fahr. in warm water. On removing from the water, the bulb of one is dried and the other left moist, and both are allowed to cool, the time required to fall from 100 degrees to 90 degrees being noted. The wet bulb loses heat by evaporation; the dry by radiation and convection. On an ideal spring day the wet bulb has been found to take 45 seconds, the dry 2 minutes and 20 seconds. The ventilation and heating in a room should, accordingly, be arranged so that the thermometers will cool at these rates. Prof. Hill and his collaborators at the London Hospital Medical College are now organizing a corps of volunteer observers with the katathermometer in British town and country districts.

The Power of Projectiles

IN the course of some remarks by F. W. Lanchester recently in *Engineering* he gives the following interesting facts in regard to the power of rifle bullets. The kinetic energy of a projectile commonly represents from 10 per cent to 30 per cent of the total energy of the explosive or powder charge by which it is projected; the lower figure corresponds to the performance of a small-bore low-velocity rifle, the latter being that approached under the most favorable conditions by the military or big-game rifle. The British Service rifle with Mark VI ammunition thus has an efficiency of approximately 28 per cent; in the ordinary sportsman's "12-bore" the figure is about 11 per cent. The total energy released on combustion by black powder is the equivalent in round numbers of 500 foot-tons per pound. The corresponding figure in the case of cordite is half as much again, or approximately 750 foot-tons per pound; and in general it may be taken that most of the explosives in common use have an energy content between 500 and 1,000 foot-tons per pound. In the case of the Service rifle the weight of the powder (cordite) is 30 grains (0.0043 pound), and the bullet 215 grains (0.0307 pound), and the velocity 2,050 feet per second. Thus the total energy of the charge is $0.0043 \times 750 = 3.2$ foot-tons, and the muzzle (kinetic) energy is 2,000 foot-pounds $= 0.895$ foot-ton; the efficiency, therefore, is $0.895/3.2 = 0.28$, as already given. It is worthy of remark, *en passant*, that there is very close accord between the figures applying to the gun and those which obtain in the gas-engine in all such matters as efficiency, heat lost to barrel (cylinder walls), and heat remaining in gases. The agreement is far closer than one would have ventured to expect in view of the great disparity in the conditions.

Ferry With Elevator Deck

THE steam ferry which is now in use at the port of Hamburg is of a somewhat original type, although there is one of somewhat the same kind employed in England. As our photograph shows, the originality consists in the use of a main deck which can be raised and lowered by suitable machinery in order to take up a difference of level of some sixteen feet. The large structural framework rises to a considerable height, and is intended to guide the whole platform in its vertical movements. By the use of powerful electric winches it is possible to raise and lower the deck as a whole, even when it is loaded with numerous heavy vehicles, such as are used in landing material at the port. The reason for adopting this arrangement of the deck lies in the fact that at the Hamburg port the difference in tide level is considerable, so that when the boat lands at the wharf it is by no means on the same level at all times, and in the ordinary case the heavy vehicles would be obliged to mount or descend a steep incline. It is in order to avoid this drawback that the present type of ferry was constructed, and as the movable deck can always be brought flush with the level of the dock, the vehicles can now run off in the ordinary way. The present ferry has a displacement of 190 tons and is about 110 feet in length. Triple-expansion steam engines of 640 horse-power run it at good speed, and it is now doing excellent service in the port. It was found best to construct a small special slip for the ferry, so that it can land without being interfered with by the wash produced by other boats. The boat is equipped with a very complete and modern electric outfit both in the way of lighting and motors for the various services.



Ferry deck that may be raised or lowered to compensate for tides.

More Dogs Wanted by the German Army

ACCORDING to the Berlin *Lokal-Anzeiger*, the German army possesses 1,200 dogs, trained to find wounded men on the battlefield, and many lives have been saved by these faithful and intelligent animals. The military authorities have called for 400 additional dogs and a civilian society, formed for the purpose, has issued a fervent appeal to owners of dogs possessed of capability of the requisite training to send in their dogs, and to accompany them as keepers and trainers, if possible. Funds for the support of this humanitarian service are also urgently needed.

Plan for the Improvement of Hell Gate, East River

By C. D. Ward

SINCE 1852 a great amount of work has been done by the United States Government to improve and deepen the waterway of the East River by removing reefs, rocks, etc. In 1868 it was decided to deepen the channel to 25 feet and, up to 1911, about $5,000,000 had been expended and 58 per cent of the necessary work had been done.

The Government later became convinced that the outlet from the New York harbor to the Long Island Sound was so important to the growing commerce of the city that it required a channel 35 feet deep in the East River to accommodate the larger vessels. To make this 35-foot channel of proper width, extending from the Battery, at the south end of Manhattan Island, to North Brother Island, where a deep channel is found, needs at many points to have rocky reefs and ridges removed, at a total estimated cost of $10,000,000. Even after the channel is thus deepened and widened the tidal currents would still be rapid, especially at Hell Gate, and, at certain times of tide, dangerous to navigate on account of the 6.7 to 8.5-mile surface currents, accompanied by violent eddies, at that part of the channel between Negro Point Bluff on the north and Hallets Point and Mill Rock on the south. On this stretch the river takes two right-angled turns, as shown on the accompanying map, which produce the violent eddies which are the cause of difficult navigation and of many accidents and wrecks.

The East River, both above Negro Point Bluff and below Hallets Point, widens out considerably, and the effect is that at a certain time of the flood tide (running north) the surface of water at Hallets Point is reported to be 1.2 feet higher than the surface at Lawrence Point, north of Negro Point Bluff. On the return tide the conditions are reversed. These great differences of level, in the short distance of about a mile, show plainly the cause of the rapid currents through the crooked and contracted channels.

The whole volume of the East River, however, does not pass Negro Point and Hallets Point, but part of it flows through Little Hell Gate, which has a present section given as 3,060 square feet, and another small part flows through Harlem Kills with a present section of only 970 square feet at low tide. The water flowing south or west through these two passages joins the south part of the Harlem River and so joins the main stream of the East River just west of Hallets Point with a small portion flowing off to the west through the Harlem River and so to the Hudson River at Spuyten Duyvil. The return tide, of course, follows the same reverse route. To reduce the violence of this current, the writer would advocate the opening of Harlem Kills to an increased width of 600 feet and 24 feet deep, and give thereby a wide channel for free navigation direct from the Harlem River to the Sound and greater flow of water to reduce the present direct current through Hell Gate. This widening of the cut to 600 feet would give a waterway of 14,400 square feet instead of 970 square feet, as at present.

Turning now to consider the contracted channel at Negro Point, it seems difficult to widen the channel materially where the New York connecting railroad bridge is to cross, as the abutments for the large arch span are already built, and with a boulevard also between the east abutment and the Long Island shore, which boulevard has to be taken care of; still, the channel being very deep in the center and shallow at each side, the writer thinks it very feasible to deepen the waterway at each side, say to 50 feet, and to also widen it somewhat and thus increase the present section of the channel from 47,316 square feet, as given by the Government engineers, to 55,800 square feet. This would materially help to reduce the velocity of the current at that narrow point. To obtain this same enlarged section north and south of the railroad bridge, the present bulkhead lines would have to be somewhat changed and, especially on the Ward's Island shore, some of the upland excavated as well as the channel deepened, as shown on the map. The cost of this deepening of channel is uncertain, owing to the limited amount of data accessible to the writer, but we will assume it would be $1,000,000.

The cost and efficiency of the plan, the writer would hope to be approximately as shown in the accompanying table.

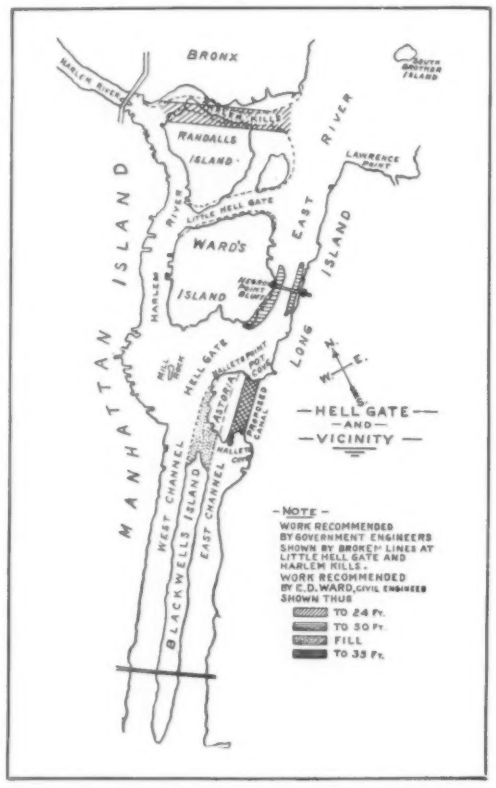
The writer would, in addition, advocate an almost forgotten plan to cut a canal through Astoria, from deep water in Pot Cove to deep water in Hallets Cove, as shown on the accompanying map.

This canal is the main and important feature in the writer's proposed plan and would give a direct and straight course from Negro Point to the East Blackwell's Island Channel without the present abrupt turns. This is not so expensive a work as at first appears. The land required for this proposed canal is now assessed, with buildings, at a valuation of $1,029,000, and would possibly cost the Government $2,000,000.

	Present Section	The Writer's Plan	
	Square Feet	Section Sq. Feet	Cost
Harlem Kills	970	14,400	$6,041,571
Little Hell Gate	3,060	3,060	.....
East River at Negro Point	47,316	55,800	1,000,000
Totals	51,346	73,260	$7,041,571

This table shows an increased area of combined water-way of 22,000 square feet, which would reduce the maximum mean velocity of the current at Negro Point in Hell Gate, from 4 miles per hour to 3 miles per hour and the surface velocity proportionately.

The writer considers that the canal should be made 500 feet wide, although a less width might do, and 35 feet deep at low water, looking to a possible deepening of the channel east of Blackwell's Island to 35 feet when commerce demands it. It is now expected the Government will deepen the eastern channel to but 20 feet, though the Government engineers advocated 26 feet, which depth at least would very naturally follow if the canal should be cut. Excavating the canal would be a large undertaking but a simple one, as it would be taken out as a dry cut entirely at small unit cost, and should not total over $2,000,000 for excavation and wasting.



Proposed straightening of East River channels.

The regular course for boats navigating the East River would then be to go north up the channel on the east side of Blackwell's Island and direct through the canal and Pot Cove and so directly on past Negro Point. Boats southbound to go by Negro Point and Hallets Point and the channel west of Blackwell's Island, as all do at present, thus making navigation very safe and avoiding collisions, though vessels could go both up and down either channel, if preferred.

Another very great benefit of the canal would be the large reduction in the maximum mean velocity of the current at Hallets Point, which would probably be reduced to about two miles per hour, owing to the large portion of the flow diverted through the canal.

The cost of carrying out the writer's proposed plan would be approximately as follows:

Widening and Deepening Harlem Kills to 600 x 24 feet		$6,041,571
Widening and Deepening channel at Negro Point		1,000,000
Total by Writers Plan not including Canal		$7,041,571
Cost of land at Astoria for canal	$2,000,000	
Cost of Excavating and Wasting Material	2,000,000	
Total cost of canal of 500 feet by 35 feet		$4,000,000
Total estimated cost of Writer's plan		$11,041,571

It is understood that this estimate does not include deepening the channel at Hallets Point Reef, Pot Rock, Ways Reef or East B. I. Channel as they are included in the general estimate of the Government engineers for deepening the East River channel.

The writer considers the advantages of his plan to be:

First: A reduction of velocity of current at Negro Point, reducing a four-mile maximum mean current to a three-mile current. The surface current would be reduced in proportion.

Second: The use of the canal would make it feasible to use the two channels at Blackwell's Island, as follows: the east one to be use by vessels going north, avoiding collisions and the dangers of Hallets Point; the west channel for vessels southbound, first passing Hallets Point with little danger either from violent currents or eddies which now cause so many accidents or collisions with other vessels at that point. This would certainly be a great benefit to the navigation of the East River.

Third: The effect of drawing off the large body of water through the canal will be to reduce materially the amount left to pass Hallets Point and to probably reduce the maximum mean velocity to two miles per hour at that point.

Fourth: Opening the Harlem Kills, giving a direct and free connection between the Harlem River and the Sound.

Fifth: The estimated cost of this plan is believed to be less than by any other equally effective one.

Finally: It would seem that the great advantages of this proposed plan will so appeal to the shipping and commercial interests of this metropolis that, in spite of the large expense and the objection always made to condemning private property for public use, they will demand that this most comprehensive plan be carried out.

With the East River Channel deepened and widened as proposed by the Government engineers and the writer's suggested improvements made, our largest battleships could then safely pass up the East River and out by the Sound to the ocean.

Cutting this proposed canal would make an island of about 25 acres in extent of that part of Astoria to the west of the canal, which land is assessed at a valuation of $1,303,800 and might cost $2,500,000 to purchase, not including an athletic ground for public school children at Hallets Point, the assessed valuation of which ground and buildings is $105,000 and covers about 2.5 acres, and is already owned by the city of New York.

This island would be very undesirable for residences or factories after the canal was cut, without a bridge across the canal to connect it with the main part of Long Island. A bridge would not be thought of, of course, and so it would be proper to change the landing of the present ferry from its present site at the foot of Fulton Street, Astoria, to the vicinity of Pot Cove near the new park, and also it would seem necessary for the city of New York to join in the improvement and buy part of the proposed island which it does not already own, to be used for a park or institution.

It is understood that Blackwell's Island is at present crowded with its various institutions and an enlargement of the island would be gladly welcomed, therefore the writer would propose that the material excavated from the canal should be used to fill in the channel between the north end of Blackwell's Island and the south end of the Astoria Island, as shown on the map, and thereby stop cross-currents at that point. This would be the cheapest and the most convenient place to dispose of the material excavated from the canal and the filled portion, added to the Astoria Island, would increase the size of Blackwell's Island by about forty acres.

If the city did not choose to use Astoria Island in that way, the writer would suggest that it might be used as a place on which the city or Government or private company could build a huge drydock, such as the city now, to our shame, does not possess; one able to dock the largest vessels that come to our harbor. Although, in some respects, not an ideal location for a drydock, still we would have there, what we have not at any of our present ones, a *good foundation* of rock, and, by placing an entrance gate at each end of the drydock, it would be unique and be rendered very convenient for vessels, either entering or leaving the dock, entering by one gate and leaving by the other. It would also be quite accessible to large vessels after the East River has been deepened to 35 feet and the velocity of the currents at Hell Gate reduced.

A Black Finish for Iron

IT is frequently found desirable to give a black finish to the metal parts of harness and equipment. This is especially the case where armies wish to be as invisible as possible. A recipe which produces a solid black patina upon iron is given in a late number of *La Nature*, giving a handsome appearance and also preventing oxidation.

The pieces of metal are plunged into a bath, almost boiling, made by mixing 10 liters of water with 65 grammes of a liquid composed of the following constituents: Strong phosphoric acid, 57 cubic centimeters; water, 57 cubic centimeters; pulverized zinc, 18 grammes. The objects to be blackened must remain in the bath for at least half an hour or more, and sometimes for as much as three hours, to produce a durable coat.

The Current Supplement

IN variety and value of its contents, the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2053, for May 8th, 1915, will be most satisfying to every class of readers. It opens with the second of a series of lectures by Sir J. J. Thomson on Atoms and Ions, particularly as related to gases. This author's statements are authoritative, and the subject is one that must be most valuable to everyone interested in science. The Submarine in Naval Warfare is most timely, describing as it does the structural elements of this new engine of war and its tactical operation as developed in the present conflict. The Scientist and the Athlete describes the physiological laboratory of the French military school. There is a valuable article comparing the cost of operation, investment, and depreciation of gas, steam engines, and turbines as used in steel works and at blast furnaces. Italian military aeroplanes are described and the leading type is illustrated. There is a review of the work of Prof. J. C. Bose. Recognizing Vocations by the Teeth discusses a phase of vocational diseases that has received little attention. There is a valuable article on Copper Cyanide Plating Solutions. The paper on the Formation of Ozone in the Upper Atmosphere is concluded. An article on the super-dreadnought discusses the doings of the new English "Queen Elizabeth" at the Dardanelles. There are also articles on Indicating and Recording Time; Salt in Its Relation to Nutrition; High-speed Bullets and Dumdums; the Combustion of Coal in Boiler Furnaces and other topics.

Industrial Accidents in Massachusetts

DATA gathered by the Massachusetts Industrial Accident Board show that in the year ending June 30th, 1914, there were 95,963 non-fatal and 608 fatal accidents reported to the commission; that the larger number of accidents occurred between 10 and 11 A. M. and 3 and 4 P. M.; and that all days except Saturdays and Sundays shared about equally in mishaps. No evidence appears that Monday morning offers a greater hazard to industrial workers than any other period of equal length. The wages of the largest group of workers suffering non-fatal accidents ranged from $8 to $15 per week, and the average wages of victims of fatal accidents showed the same group range. The maximum number of accidents occurred to workers earning from $11 to $12 per week; the wage-earners from 21 to 29 years of age met the largest number of non-fatal accidents, while the greatest number of fatalities were suffered by workers from 40 to 49 years of age. Of the whole number of non-fatal accidents, disability lasted less than one day in 40,661 cases. In 79 per cent of the cases the average duration of disability was two weeks or less. The average duration of disability was 12.48 days, approximately the same as in 1913. Taking the days lost as a basis, 3,992 persons were constantly disabled for a full year. The wages loss for the year was $3,172,440. Exclusive of insurance administration, the average cost of workmen's compensation per case was $23.93. The number of accidents per thousand employees for twenty selected branches of industry was as follows:

Industry.	Number per 1,000.
Automobile factories	271
Foundries and metal working	257
Slaughter and packing houses	178
Electrical supplies	164
Rubber factories	153
Box makers (wood)	125
Tanneries	116
Car and railroad shops	99
Box makers (paper)	74
Candy	66
Woolen and worsted mills	65
Cotton mills	64
Dyeing and finishing textiles	56
Carpet mills	55
Marble and stone cutters	54
Boots and shoes	51
Makers of blank books	45
Knitting mills	43
Jewelry factories	39
Clothing makers	21

To Old Readers of the Scientific American

THE June number of the SCIENTIFIC AMERICAN will commemorate the seventieth anniversary of the house of Munn & Co. In that number we wish to give a history of the SCIENTIFIC AMERICAN. Old readers and subscribers who visited the editorial offices in the past are requested to send us their impressions, anecdotes, experiences, and the like. Indeed, any information at all relating to the old offices on Park Row will be gratefully received by the Editors.

Why Not Safeguard the Robes?—If you have gone to a theater in an automobile you will have noticed the anxiety of the owner concerning his robes, especially as to whether they will be there when returning after the play. Is it not practicable to devise some means whereby any disturbance of the robes would cause an alarm, as the ringing of an electric bell or a turning on of the lights, so that the care-taker of a large number of automobiles would be notified instantly of interference?

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Persistent Trail of a Meteor

To the Editor of the SCIENTIFIC AMERICAN:

At about 6:30 P. M. March 9th I witnessed at this town a very interesting meteorological phenomenon. While waiting for a train, I, with several other persons, was attracted by a falling meteor of exceptional brilliance descending in an almost vertical line, in a due westerly direction.

The extraordinary feature of this occurrence was the trail of white smoke or vapor it left in its wake. This vapor marked accurately the path of flight of the meteor and persisted in this position for some minutes.

To us observers, this vapor appeared to be not more than four or five miles away; however, on boarding the train we traveled at least four miles north before we seemed to be any farther north of the vapor than we were in Strang, proving that it must have been at a great distance from us.

The possibility of its being a bomb or anything of that nature is very remote. The falling of this body, notwithstanding its exceptional brilliance, is hardly remarkable, but the trail of gas, smoke or vapor, or whatever it was, is to me at least an extraordinary occurrence.

Strang, Neb. DR. J. C. HICKMAN.

[The visible trail left by a meteor, although usually of very brief duration, sometimes persists for several minutes, and even, in very exceptional cases, for an hour or more. These persistent trails are occasionally visible by daylight as well as at night.

A comprehensive account of such trails and an attempt to explain the conditions under which they occur was published in the *Popular Science Monthly* of August, 1911, by Prof. C. C. Trowbridge of Columbia University, and an abstract of this article appeared in the SCIENTIFIC AMERICAN of September 2nd, 1911, page 209. Prof. Trowbridge thinks that trails of long duration can occur only in a stratum of the atmosphere lying between forty-five and sixty-five miles above the earth's surface, and he calls this region the "meteor train zone." According to his hypothesis, the persistent trail is a phenomenon similar to the afterglow following an electric discharge in a vacuum tube and is possible only in a highly rarefied atmosphere.

Assuming the trail seen by Dr. Hickman to have been fifty miles above the earth, its distance from the point of observation may have been from one hundred to several hundred miles.—EDITOR.]

Co-operative Boards of Health

To the Editor of the SCIENTIFIC AMERICAN:

Regarding your issue of April 10th, 1915, there occurred an editorial on "A Co-operative Health Board." The chairman of the Board of Health of Belmont, one of the towns included in this co-operative health plan, called my attention to the fact that in your editorial, as in an earlier editorial in the *World's Work*, the town of Belmont was omitted from the list.

A very complete record of the work of the organization up to April 1st, 1914, is given in reprint No. 222 of the United States Public Health Service, written by Prof. Phelps, formerly of the Massachusetts Institute of Technology, and now of the United States Public Health Service.

I am writing this letter with the idea that you might wish to refer inquiries to an authoritative report regarding the work of the Co-operative Health Organization. ROBERT N. HOYT,

Wellesley Hills, Mass. Agent.

Right-hand vs. Left-hand Drive

To the Editor of the SCIENTIFIC AMERICAN:

I have noticed a couple of communications in the SCIENTIFIC AMERICAN regarding the tendency of drivers of left-hand driven automobiles to take to the middle of the road. I tour a good deal in a seven-passenger Franklin touring-car, right-hand driven. I usually sit in the front seat with the chauffeur, which brings me on the left side of the car, and gives me a splendid opportunity of observing how the cars we meet are run. My experience is that the left-hand driven cars all "hog" the road. I was out for a 30- or 40-mile drive yesterday, and this peculiarity on their part was particularly noticeable.

Southern California has hundreds of miles of splendid roads, either built by the various counties or by the State Highway Commission. Some of these roads, the first that were built, are but 16 feet wide, being built of rock macadam with asphalt surface. Others are 24 feet wide. The tendency of the left-hand driven car to get out of its place on the road and take to the center of the drive is especially noticeable upon these 16-foot drives. I was riding a few days since with a gentleman who was driving a left-hand driven car. I called his attention to the fact that he was in the middle of the road. He immediately pulled off to the side of the road, saying that he had not noticed it. Within five minutes he was back in the middle of the road.

Now, there must be something in the position of the driver that causes this conduct. It cannot be that all the drivers of left-hand driven cars have simply become lawless. I think that they are unconscious of doing it. Before the days of automobiles, I always kept a good team and drove a great deal myself, and I never felt comfortable sitting on the left-hand side of a vehicle; in fact, I was almost helpless. It may be possible that those who have driven right-hand driven cars have something of the same feeling. I defy anyone to take a drive any Sunday or holiday in this county, when there are thousands of cars going and coming, without being impressed with the facts that I have stated above.

Los Angeles, Cal. J. A. GRAVES.

An Early Use of Khaki

To the Editor of the SCIENTIFIC AMERICAN:

In your correspondence column of April 3rd the question is raised as to when the khaki dye was first used for soldiers' uniforms and the writer dates it back to 1877. Now, I wore khaki-colored uniform in 1858 during the Indian mutiny war, being then in the East India Company's army. The uniform worn by us at that time had been white drill, but it was found to be unfit for the rough work of the campaign; it showed the dirt too much. So orders were given to have it dyed a brown color called khaki, used by the natives. This was at Ahmednuggur, Bombay Presidency. The dye was very inferior, did not stand washing well, but it served not only the original purpose, but also that of making our soldiers less conspicuous to the enemy.

JOHN P. DUNLOP.

The Donation of Patents to the Public

To the Editor of the SCIENTIFIC AMERICAN:

The important inventions of Dr. Walter F. Rittman relating to the production of gasoline and certain bases for high explosives and his dedication of the United States patents to the public have attracted much attention and aroused the admiration of all for the inventor's patriotism. There is some question, however, whether the dedication of this patent will operate to the benefit of the public to the same extent as if the patent had been privately operated with a reasonable regard for the public. Is it probable that the telephone would have the universal use and the practically unlimited range it now offers the people if it had not in the first instance enjoyed the fostering influence of our beneficent patent system?

Senator Orville H. Platt of Connecticut, in addressing the U. S. Senate in 1884, touched upon this very point in referring to the inventor as "a laborer entitled to his hire, entitled to it more, if possible, than any other laborer, as his labor is higher in dignity and grandeur than that of any other laborer." He quotes the testimony of Sir Henry Bessemer of steel fame as found on page 103 of a work called "Creator of the Age of Steel," a part of which is as follows: Sir Henry says, "I do not know a single instance of an invention having been published and given freely to the world and being taken up by any manufacturers at all. I have myself proposed to manufacturers many things which I was convinced were of use but did not feel disposed to manufacture or even to patent. I do not know of one instance in which my suggestions have been tried; but had I patented and spent a sum on a certain invention . . . I should have found someone who would have taken it upon the offer of some advantage from me and who would have seen his capital recouped by the fact that no other manufacturer could have it quite upon the same terms for the next year or two. . . . I believe inventions which are at first free gifts are apt to come to nothing."

Do not the views of this distinguished man give us food for thought in this day? The writer thinks that the views of Edison, Marconi, the originators of the commercial moving-picture machines, and other leading inventors might bring the public to believe that the reasonable control of an invention afforded by the patent laws is a benefit to the people at large as well as to the inventor. A CONSTANT READER.

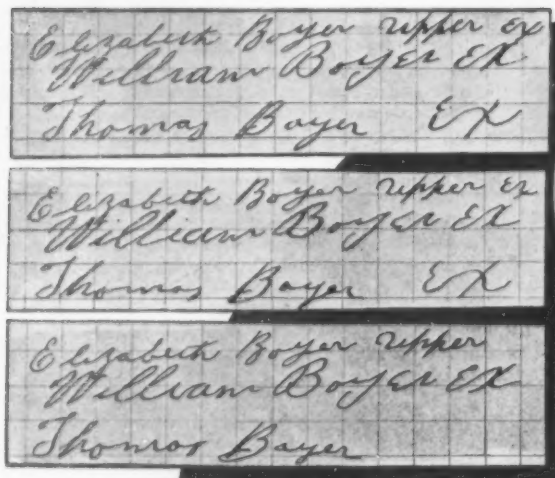
Fly Trap Wanted.

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of October 10th last (page 240) there was given a description of a fly trap recommended by the Department of Agriculture, which, after trial, we find most ineffective. The best fly trap we have found up to date is the ordinary glass dome trap, but we should be glad to try any form of trap which can be made here, which any of your readers may be able to recommend. F. E. MULCAHY.

Explosives Factory, Hiratsuka, Japan.

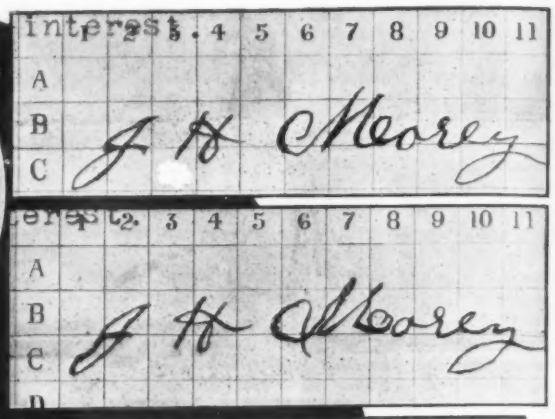
Traced forgeries, photographed under ruled squares.

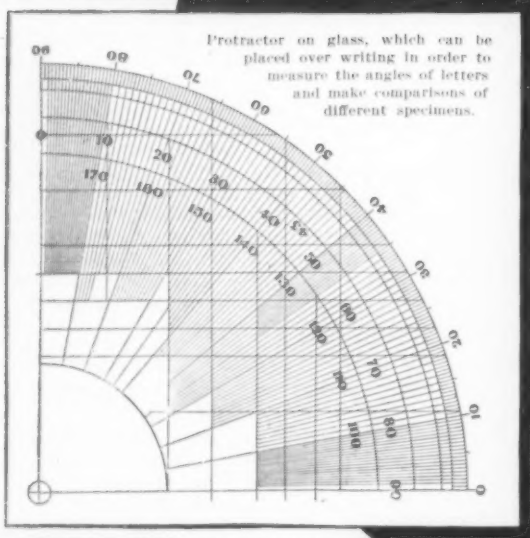


Stereoscopic microscope on glass table with light beneath.

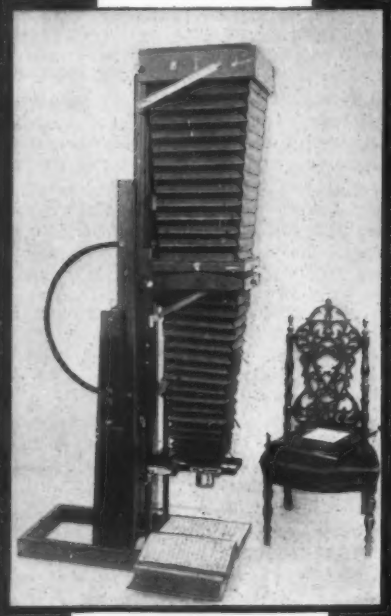
Albert S. Osborn

Traced forgeries, showing damaging identities.



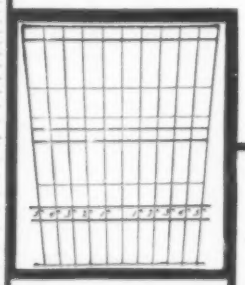


Protractor on glass, which can be placed over writing in order to measure the angles of letters and make comparisons of different specimens.

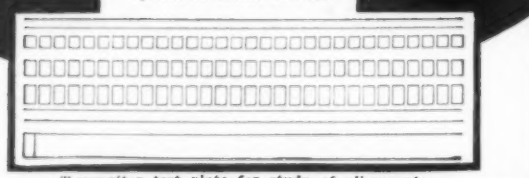


Special document camera.

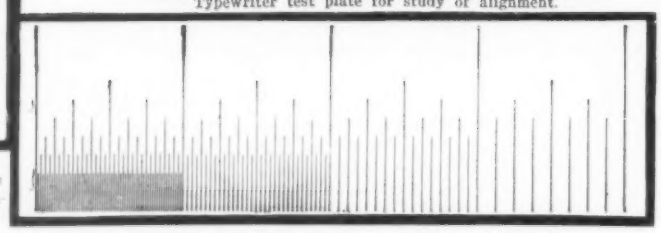
Typewriter line measure, from one 64th, increasing by 256ths of an inch.



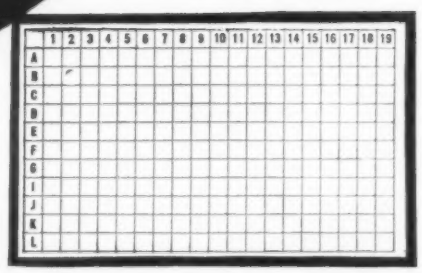
Typewriter protractor ruled on glass for comparing letter angles.



Typewriter test plate for study of alignment.



Four-inch measure on glass, 8ths to 64ths of an inch.



Glass plate ruled in squares, all exactly the same size. By means of this gage, which is placed over a specimen of writing to be examined, every detail of a letter or word can be analyzed and accurate comparisons made, showing identities or differences; a result which could not be obtained in the older methods.

Science and the forger—instruments and illustrations in questioned document cases.

Science and the Forger

Instruments and Illustrations in Questioned Document Cases

By Albert S. Osborn, Author of "Questioned Documents"

THE giving of definite reasons for an opinion and the use of illustrations and instruments in proving the facts in a court of law in a questioned document case is a proceeding so comparatively new that it is always objected to, and now and then not permitted. The old idea of evidence in these matters was that it should be received through the ears, and a case was "heard" and not "seen," and the modern method of interpreting and illustrating testimony and thus showing the facts in visible form has met with vigorous opposition.

Not until recently was any standard writing admitted in evidence for comparison, nor was any juryman permitted to look at a photograph or at evidence through a microscope, but was simply told what others saw, or knew, or thought, and there still are courts where jurymen are not permitted to see for themselves. Some of the old objections were no doubt originally based upon the then reasonable presumption that the juryman could not read and write, and was therefore more likely to be deceived and misled by his own eyes in a document investigation than by the oral testimony of others, but the same rules made it impossible to show anything to an intelligent referee or an able and experienced judge. In the ancient practice, therefore, the one called upon to decide the case was supposed to listen to what others said regarding a disputed document and then try to determine, often from conflicting stories, who probably was telling the truth.

The old method is slowly passing away in all cases where evidence can be made visible, and judge, referee, and jury are asked to look for themselves at the physical facts with all kinds of microscopes and magnifying glasses, and these facts are interpreted and made plain by special enlarged photographs and grouped illustrations. By these methods the observer, by the use of two senses, certainly is better able finally to understand what the fact is and determine who is telling the truth. The modern practice that makes evidence appeal to two senses instead of only one is now becoming generally recognized as entirely reasonable and desirable. In this manner has arisen the necessity for instruments and illustrations in disputed document cases.

As was inevitable, these modern methods of presenting evidence have had a marked effect on the administration of justice, and by their use a verdict is based not upon the amount of the evidence, but upon its quality, and some of the discredit brought upon expert testimony by vague and intangible evidence of the doctors and the alienists is being removed. One competent witness on the side of the facts can prevail against a room full of witnesses against the facts. In a recent important case six alleged eye-witnesses testified that they saw a certain document signed and twelve jurymen, to whom the facts had been shown, declared it to be a forgery.

The completely equipped examiner of questioned documents in these days needs certain instruments for his business as much as the surveyor does for his. The photographic camera, the microscope, and the necessary instruments for making accurate tests, measurements,

and illustrations are the charts and compasses of the business, and they, with the aid of the witness, really present the testimony. In all disputed document cases there are two requirements: first the discovery of the fact and then the proof of it in court. The qualified expert may not need to use instruments or to make illustrations in order that he himself may discover the fact, but instruments and illustrations often are absolutely necessary in order that the inexperienced and untrained who may be called upon to decide the question may be led to see clearly and appreciate fully the significance of the visible physical facts.

The whole of modern procedure in relation to proof of documents is thus being revolutionized by this method of making concrete and visible the main testimony in such cases. This method also in large measure takes document testimony out of the class of mere expert opinion testimony, with its inevitable conflicts, and puts it into the class of demonstrative testimony which in many cases can be readily seen, properly appreciated, and fully understood by an intelligent juryman.

Without the aid of the photographic camera a handwriting or document case can hardly be properly presented in a court of law. Seeing ability varies greatly with different individuals, and even a slight enlargement makes more distinct and may actually make visible to certain observers what otherwise cannot be seen. A suitable enlargement often presents a matter so much more clearly that the evidence at once carries conviction. Photographs also permit a side-by-side comparison by making it possible to put things close together, which is the only way certain things can be effectively compared, because of the inability of the eye to carry an image for even a brief time or over a short distance. With most observers, therefore, visible things to be compared must be looked at at the same time. Photographs make such comparisons possible by permitting the dissection of accurate reproductions of documents and the grouping of similar or dissimilar parts.

The psychology of habit underlies much of the scientific study of the subject of disputed handwriting, and the principles of psychology have a most important bearing on many phases of the study of the subject of forgery. Given the same conditions, minds work in much the same way whatever they are attempting to do. One of the greatest obstacles to success in forgery is overanxiety to do it well, and this effort shows itself in the tangible result. The forger locks the door, pulls down the curtains and tries to do the task so well that he overdoes it. Furthermore, he usually is not satisfied with the result as it first appears and often carefully repairs it, adds to, overwrites, and perfects his first attempt. Such careful corrections or additions, always inconsistent with genuineness, may not change the color of the ink, and if skillfully done may not be seen under ordinary view, but when examined or photographed by strong transmitted light, especially under magnification, the telltale varying thicknesses of the ink film are instantly disclosed, enabling the observer literally "to see through" the forgery.

Most forgeries are produced either by a tracing process or by a simulating process. In tracing, the operator seeks to reproduce line for line and dot for dot a genuine signature with the natural thought that if he can make one just like a genuine one, no one can detect it, and then, in addition, he is often so shortsighted as to put this very model signature in evidence in the effort to prove his imitation to be good, because it is "just like" a genuine signature. It does not occur to him until he is arrested or he presents his forgery in court that genuine signatures are not just alike and that it is a very damaging circumstance when a disputed signature is exactly like a certain genuine signature which may have been used as a model, and what he thought of as evidence of genuineness naturally becomes evidence of forgery. This identity is especially damaging when the disputed signature in its line quality and retouching shows that it was not really written but slowly and carefully drawn. In such a case it is desirable to illustrate this damaging similarity, which is done by photographing the disputed signature and its model under ruled squares so that merely by inspection the damaging similarity can be seen.

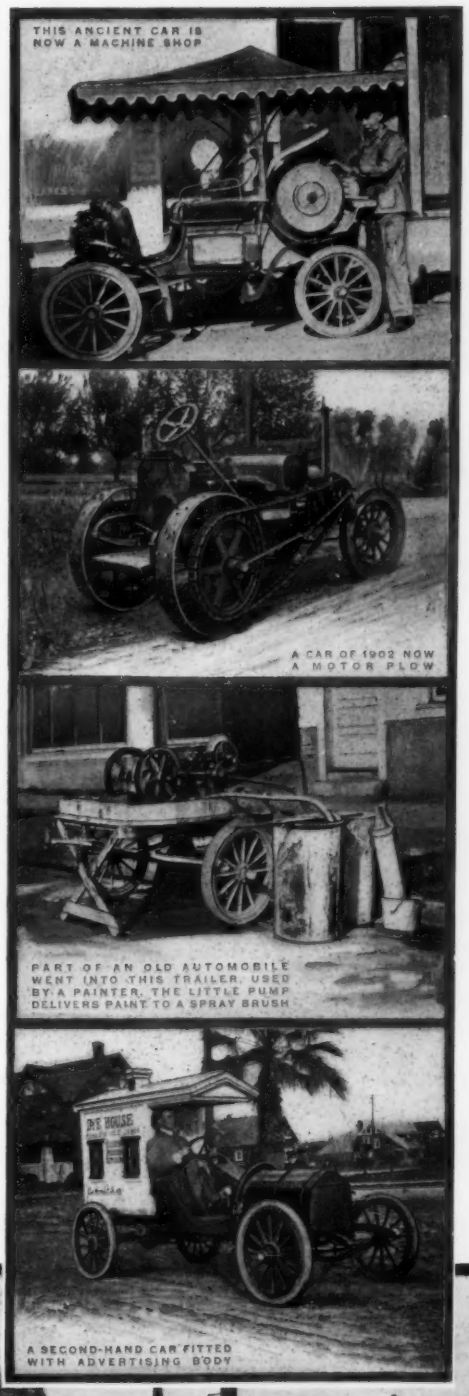
In certain cases means for making and illustrating accurate measurements are essential if the facts are to be proved. In a typewriting case the falsity of a document can sometimes be shown by simply showing that certain letters are narrower or wider than other letters. It is necessary in such cases that measuring instruments be provided that enable an ordinary examiner to see and appreciate the physical facts.

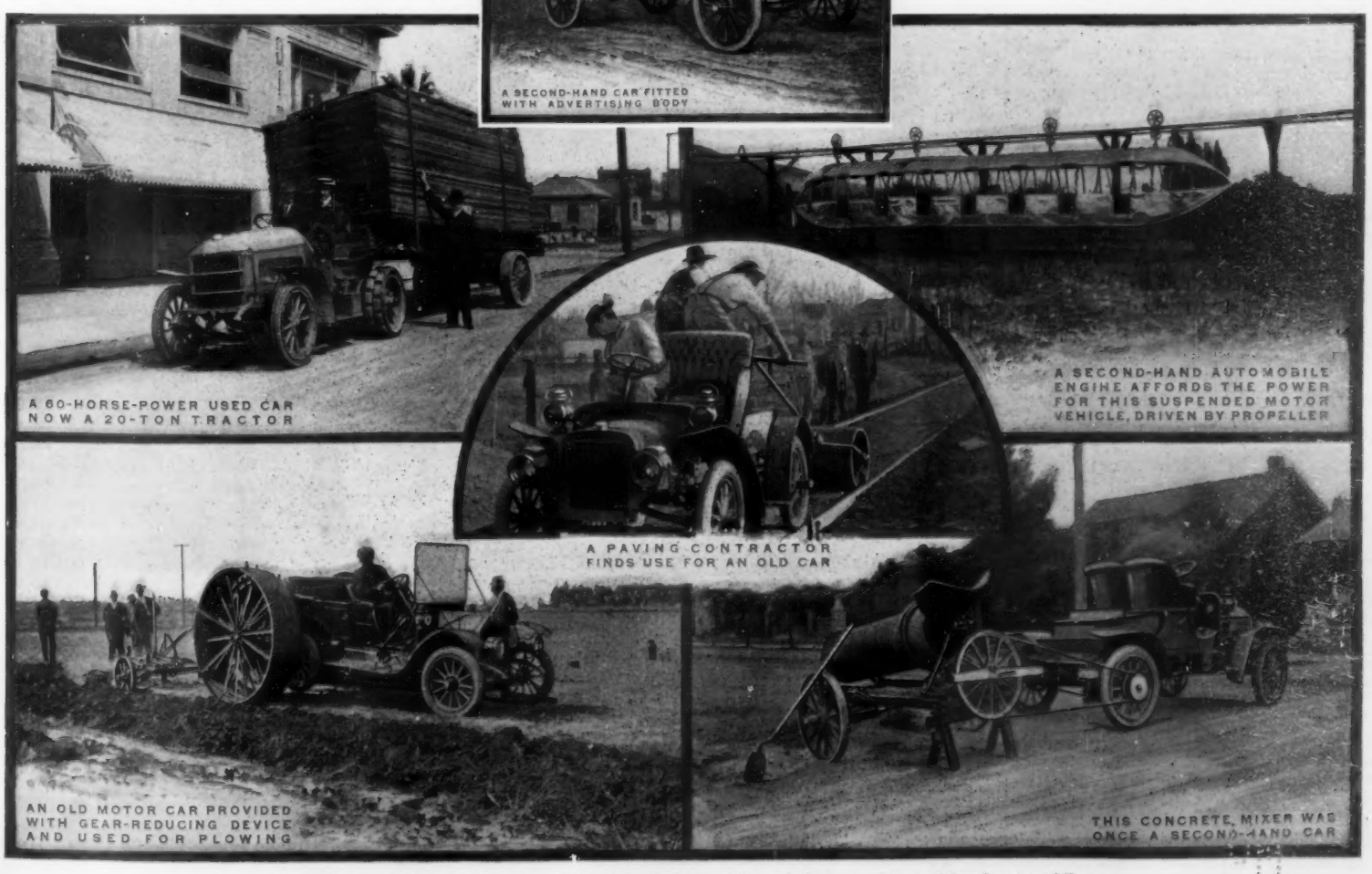
What Becomes of the Second-hand Automobile?

THE accompanying photographs answer in part the question that everyone has asked at one time or another, "What becomes of the second-hand auto?" With so many thousands of new cars constantly coming on the market, it seems as if there would be a tremendous oversupply of used cars of antiquated model that would be impossible to sell for pleasure vehicles, and that would have to go to the junk pile. The ingenious manner in which small tradesmen, ranchers, advertisers, and mechanics in various lines of industry have solved this problem is vividly shown in the series of pictures of re-built machines, many of which are adapted to uses that their manufacturers never dreamed of.

A cement contractor has fitted up a trailer composed almost entirely of the parts of outworn autos, which makes a very effective concrete mixer, and which is towed by his little runabout, also a second-hand machine. A knife grinder has set up a complete shop for

(Concluded on page 440.)



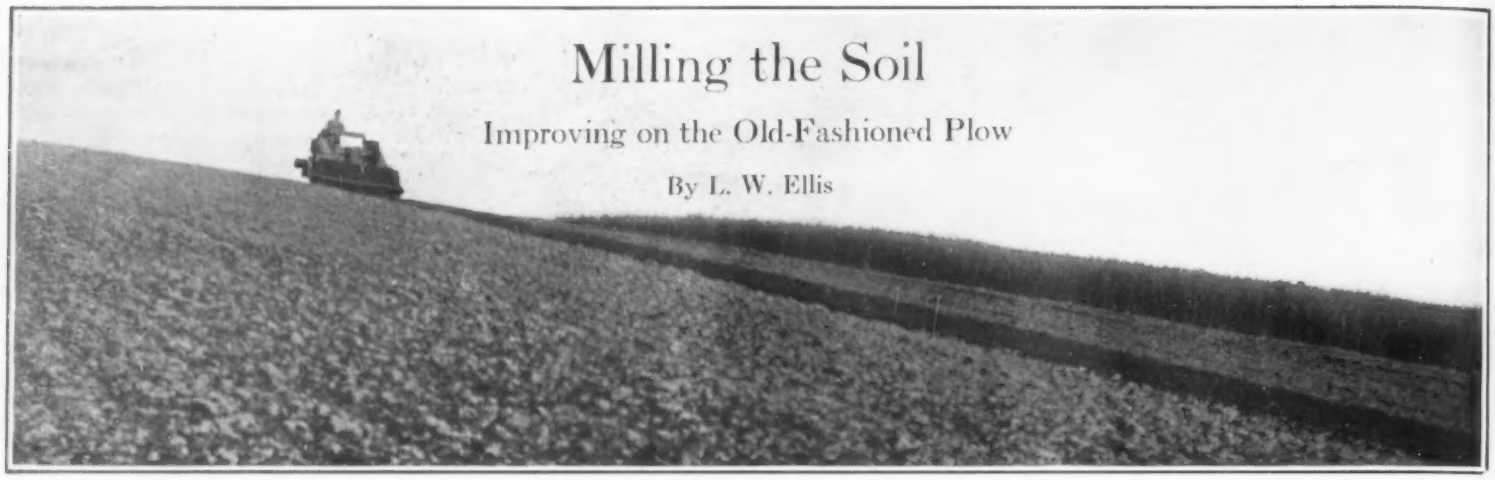


A series of re-built machines that have solved the problem of the use of second-hand automobiles.

Milling the Soil

Improving on the Old-Fashioned Plow

By L. W. Ellis



Deep cultivation on fallow land by a Meyenburg soil miller.

THE Greeks gave Ceres credit for inspiring one Triptolemus to invent the plow. Later students have suggested that the supposed divine origin of the implement had something to do with barring sacrilegious improvements upon it until a little over a century ago, when Thomas Jefferson reduced it to mathematical principles and the first real plow manufacturing began. Certain it is that anything so radical as a proposal to abolish the plow altogether would be regarded by the average farmer as unthinkable were it not for the fact that at least two types of rotary autocultivator had reached the practical marketing stage in Europe previous to the war, one of them being manufactured in this country also. This type of machine, variously known as a rotary cultivator, soil milling machine, motor hoe, etc., pulverizes the soil thoroughly at one operation to the full depth of the cut, no disks or other harrows being needed for preparing a seedbed of ideal physical conditions.

Since Jethro Tull first outlined the modern principles of tillage, the aim of implement designers has been to break up the furrow slice into the granules which afford greater root pasturage, hold abundant moisture, and provide for proper soil aeration. The indictment of the plow is that it is a makeshift, merely a combination of wedges for making the best possible use of the one power always available hitherto, i. e., the linear pull of a draft animal. Only rarely does it effect a complete pulverization, and in the hand of a careless farmer the plowsole may easily form a so-called "share hardpan" and work considerable damage to the land.

The crop return due to the better preparation of the soil has long been recognized, and Kropotkin's colony of exiles in England is said to have shown a profit even after putting soil through a grinding machine and restoring it to its place.

So long ago as about 1850, an English farmer, Hoskyns by name, recorded his theory of a motor cultivator embodying a rotary working tool equipped with mole-like claws for scratching the earth. He condemned the plow and the implements that follow it, and insisted that the proper application of mechanical power to the soil was in a rotary direction, citing the successful rotary action of the paddle-wheel, the circular saw, the threshing cylinder and other devices working directly upon material to be moved or changed in form.

Hoskyns's idea of a rotary tool has since been applied to many experimental machines in this country. A South Dakota college professor advanced the idea of a soil auger. A Kansas farmer fitted a drum with a large number of miniature plows. A Colorado man built an earth saw, and a California inventor brought forth a spading wheel. A Nebraska company propelled a tractor by an immense cylinder studded with hooks which were supposed to tear up the ground at the same time. European inventors duplicated all these ideas and more, but all failed, commercially.

The one principle which has endured is that of a vehicle carrying at the rear a horizontal cylinder of some sort, actuated independently of the vehicle, and equipped with comparatively small cutting tools. Of the two types of cylinder employed—one rigid, the other flexible—the latter unquestionably does the superior work, bearing out Hoskyns's prediction of 1850.

The advantage of the rigid type is a probably lower repair bill except in stony ground, a concession to which is made in one case by wooden break-pins, acting as a safety feature. The flexible tool, on the other hand, takes a smaller "bite," scratching, rather than cutting, and producing much finer granules.

The Meyenburg soil miller.

The American-built soil miller.

Milling claws and soil bed prepared by the Meyenburg machine.

One machine of the flexible type made in the United States is of Swiss invention, after researches instituted about 1901 by one St. Georgen, in Zurich, and carried to a successful issue by Konrad von Meyenburg of Basel. The vehicle itself is not important; in fact, in the earlier experiments the tool was mounted upon a wagon drawn by a block-and-tackle. The essentials at present seem to be lightness; a short wheel base; independent control of drive wheels so one may be stopped and a very short turn made; a separate drive for rotating the cylinder; means for raising and lowering the cylinder; and, of course, a motor. It is interesting to note that after an exhaustive survey of the world's light motor field, the Swiss inventors chose for their experimental work a two-cycle marine motor made in the United States.

The rotor, or cylinder, runs in the same direction as the travel of the machine and actually helps to propel it. The outfit can thus be made very light—4,500 pounds for a two-meter width and 1,400 pounds for the one-meter. Three or four speeds are provided, since the condition of the soil and depth of cut will naturally affect the rate of travel. A motor of 30 horse-power furnishes power to till from four to ten acres in ten hours, at depths of about 12 to 3 inches, respectively, a very creditable showing, considering the amount of material subdivided.

The cylinder is, of course, the vital feature. Flexible steel claws, held by steel spring holders, are ranged about a horizontal axis, and the whole rotated at about 150 revolutions per minute. Use in stony, hard, wet, and trashy ground has apparently brought out no limiting factor so far as quality of work is concerned, though the best of material is required in the hooks and holders to postpone crystallization.

Briefly, the advantages of such a tillage tool, outside of the use of mechanical power, are the preparation of a more favorable seed bed; immediate mulching of the soil and its increased water-holding capacity; uniform distribution of manure; saving of seed; greater yield. In addition the vehicle can be applied to some of the uses of an ordinary tractor. The mechanical perfection of the machine and its adoption by the average farmer will no doubt be slow. The fact that it is already a commercial product is, however, significant in view of what may very likely prove to be a profound revolution in methods of handling the soil.

A Simple Poison Indicator.—To indicate that a bottle contains poison a patent, No. 1,131,839, to Mahalah T. Hudson of Kirksville, Mo., shows a frame carrying a bell which will ring when the bottle is moved, the frame having a plate with depending spurs which can be forced into the top of a cork in order to anchor the frame upon the cork of the poison bottle.

Courtesy of *London Illustrated News*

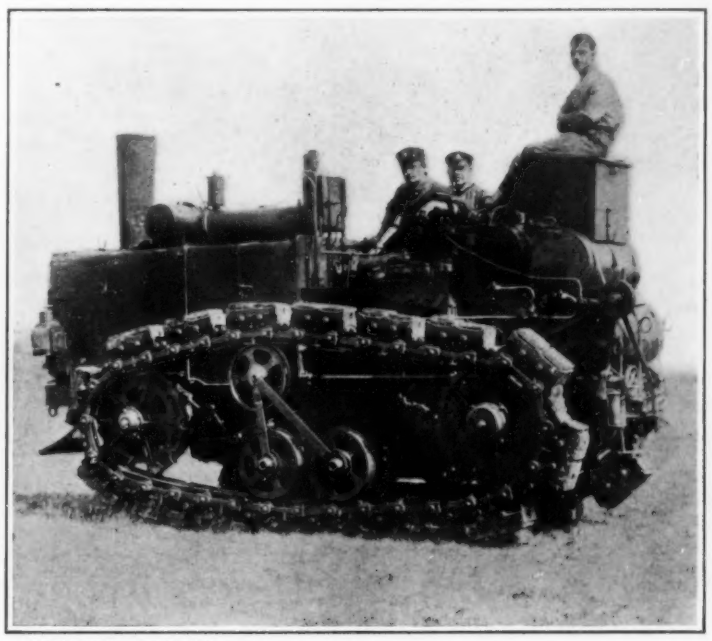
Bullet-proof shield on wheels for attack or defense.

An armored shield behind which men may advance or may barricade a road, or the like, was submitted recently to the British War Office. The small pictures show various uses of the device. It may be transported like a two-wheeled cart, carrying on the shield plate a supply of ammunition. It may be used as a temporary barricade or as an advancing or retiring shield, or the wheels and springs may be removed to form a fixed barricade. Ten such shields placed side by side form a 30-foot barricade.

Photo by Paul Thompson

A pocket periscope.

The British army has just adopted an angle mirror periscope which may be attached to a bayonet point to give a view over the rim of a trench.



Copyright American Press Association

British caterpillar tractor.

The warring nations have found the caterpillar and ped-rail type of tractor indispensable for hauling artillery and equipment over uneven ground. This picture shows a machine used by the British army. Intermediate of the main sprocket wheels are idlers adapted to take up slack and provide better traction.

Courtesy of *London Illustrated News*

A 42-centimeter shell.

This unexploded 42-centimeter shell fell in soft ground near Verdun. Height, 1½ m.; weight, 2,108 lbs. A French 75 mm. on left, and German 77 mm. on right.

Photo by Paul Thompson

Protection against poisonous fumes.

The poisonous fumes that are given off by the explosion of modern high-power shells make it necessary for the men in the trenches to wear special or improvised respirators.

Copyright Brown & Dawson

Elephant as a war horse.

We would not be surprised to find elephants doing service in the Indian contingent of the British forces, but apparently even the German army makes occasional use of them.

Photo by Paul Thompson

Traveling boiler of the German Red Cross Division.

It supplies filtered sterile water for washing wounds.

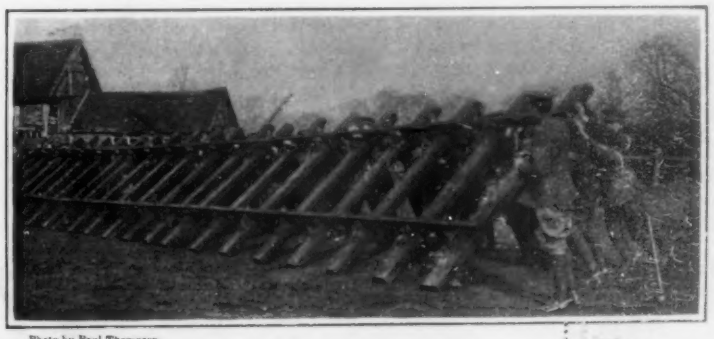
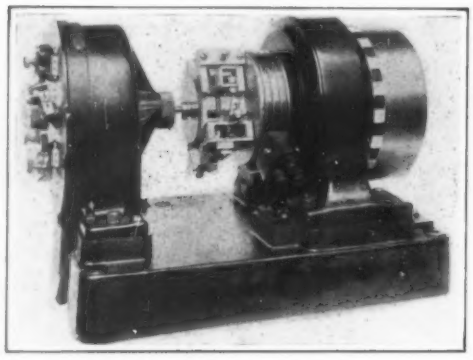


Photo by Paul Thompson.

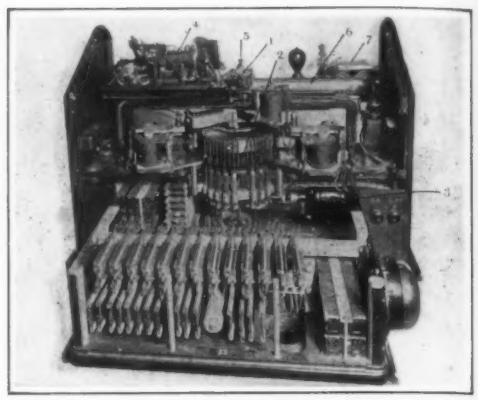
Railway construction drill.

British recruits learning how to build a light railway.

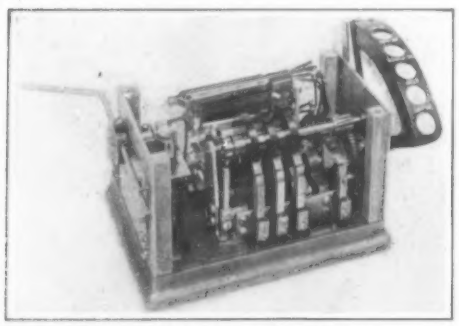
The tape perforator.



The motor and the distributor.



Interior of the printer and relay, which is operated by the transmitter of the distant station and prints the message on a telegraph blank.



Interior of the automatic controller.

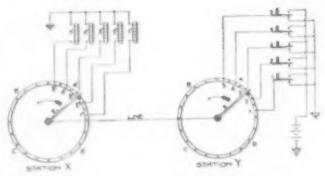


Fig. 1.—Subdivision of the quadrants.

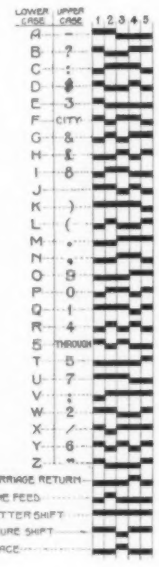
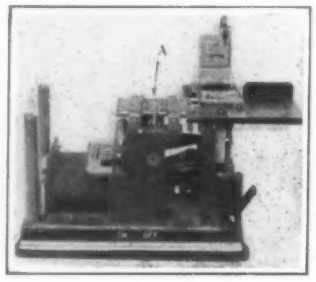


Fig. 2.—The Baudot multiplex transmission.



Interior of the transmitter.

Fig. 3.—Baudot code.

Transmitting and receiving apparatus.

Some of the apparatus used in the new multiplex page-printing telegraph.

A System of Long Distance Typewriting

Eight Messages Sent Simultaneously Over a Single Wire

FOR over a year the Western Union Telegraph Company has been putting to a rigorous test in actual commercial service what is virtually a system of long-distance typewriting. In other words, the operator at the transmitting station uses a keyboard similar to that of a typewriter, but the typing is done at the distant receiving station, and there directly on a telegraph blank, so that no time is lost in transcribing the message, as is usually necessary.

Broadly, it is a combination of two existing systems, namely, the multiplex system of Baudot and the page printer of Murray. Of course, the combining of these two systems has involved a great deal of invention and has resulted in the development of many improvements, credit for which belongs to the engineers of the Western Electric Company, who designed and built the apparatus, and the engineers of the Western Union Telegraph Company who co-operated with them.

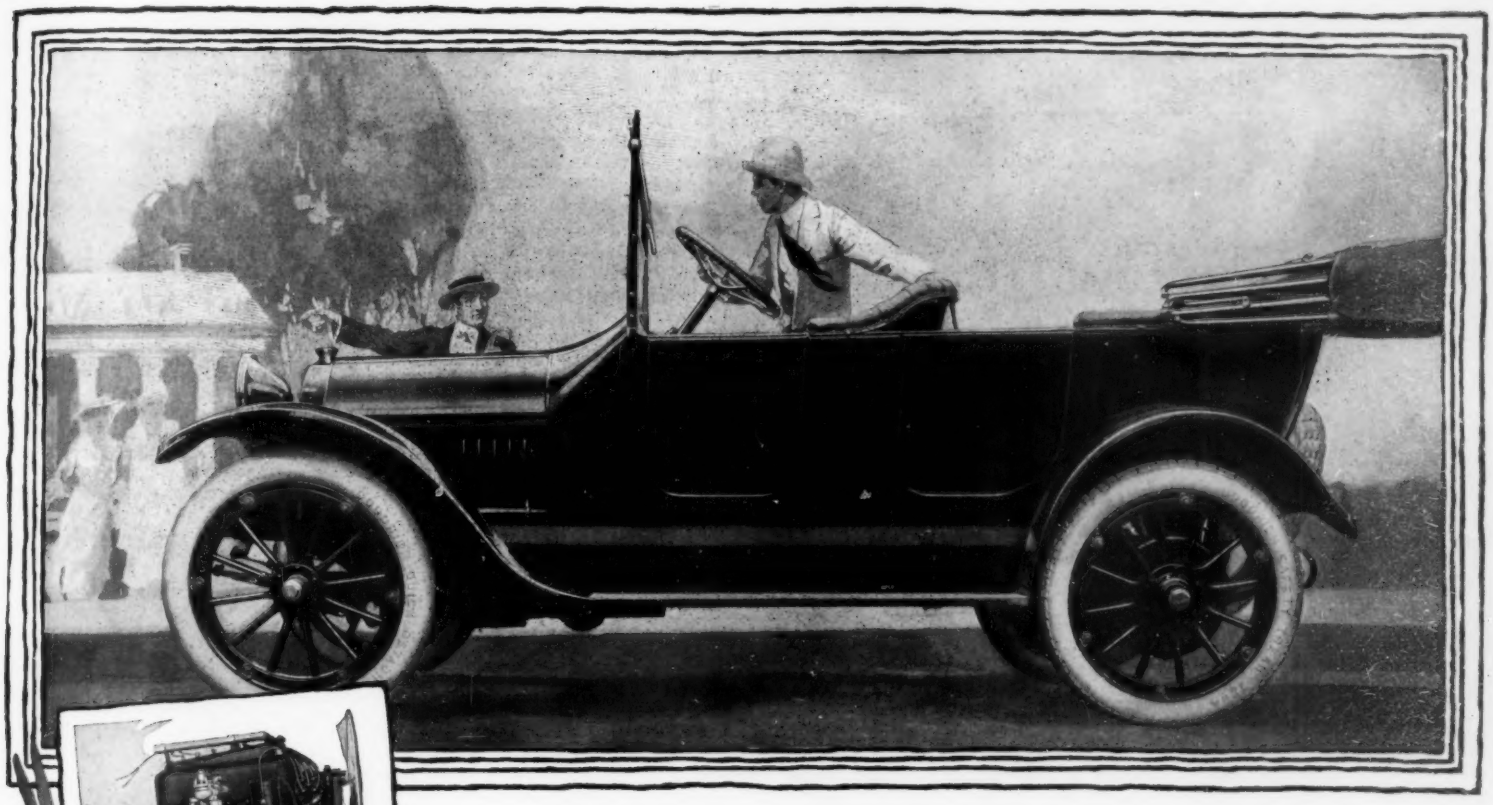
Each key of the transmitting keyboard sends its own characteristic signal or set of electrical impulses over the line, which actuate the printing mechanism at the far end and cause it to impress the corresponding character on the paper. However, the signals used belong to the Baudot code rather than the Morse alphabet. This is illustrated in Fig. 3, and it will be observed that every letter is made up of five units, consisting of positive and negative impulses, instead of dots and dashes. Those above the line in the illustration represent positive units and those below negative. Thus, the letter "A" consists of 1 and 2, positive, with 3, 4 and 5, negative, while "B" consists of 1 positive, 2 and 3, negative, and 4 and 5, positive. The code is shortened by the use of an upper case controlled by a special key as in a typewriter, which provides for punctuation and numerals, as well as certain abbreviations.

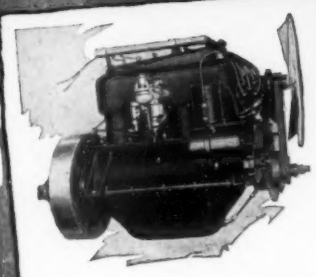
We have referred to this system as one of long-distance typewriting; and this is particularly true of one form of apparatus known as the "short line printer," in which, when the operator depresses a key, the printer at the receiving station immediately impresses the corresponding letter on the telegraph blank. But the transmitting and printing mechanisms are capable of far higher speed than is a human operator, and for this reason the Baudot system of sending signals from four different operators in rapid succession has been adopted. This principle is illustrated in Figs. 1 and 2. In Fig. 2, for instance, two contact rings are shown, one at the sending station *Y*, the other at the receiving station *X*. These are divided into the quadrants *A*, *B*, *C* and *D*, and *A'*, *B'*, *C'* and *D'*, respectively. Sweeping over the quadrants are the contact arms *E* and *E'*, respectively, which are connected by a telegraph line and which are arranged to revolve at a uniform rate, so that quadrant *A* is electrically connected with the quadrant *A'*, quadrant *B* with *B'*, etc., once at each revolution. Now consider the quadrants subdivided into five segments, as indicated at *A* and *A'*, in Fig. 1. Each segment of quadrant *A* is connected to a lever which may engage one of two contact points. One point is grounded and the other is connected to a grounded battery or other source of electrical current. The corresponding segments of *A'* are respectively connected to ground through relays. If, for instance, levers 1 and 2 were raised so as to engage the battery or active contact points, the arm in sweeping over quadrant *A* would transmit two electrical impulses over the line which would pass through the corresponding segments of quadrant *A'* at station *X* and energize the relays 1' and 2'. The next instant the contact arms would sweep over quadrants *B* and *B'*, sending a set of impulses to relays controlled by *B'*, etc. The relays of each quadrant operate their own printing mechanism. Of course, the diagrams do not show the exact mechanism employed in this system, but merely illustrate the broad principle of operation, showing how four signals can be sent on a single wire by four different operators, and sorted out at the receiving end so as to operate four different printers. Then, by means of a duplexing system, signals can be sent over the same wire in a reverse direction from station *X* to *Y*, so it is possible to transmit eight messages over a single line.

One of our photographs shows a multiplex table equipment with only one transmitter and one receiver, which serves to illustrate the various apparatus required. Of course, for a complete quadruplex-duplex system this equipment would be increased four-fold. By operating the keyboard a paper tape is perforated, and this passes through the transmitter, where a set of fingers bear against the tape and, operating through the perforations, raise the levers corresponding to those shown in Fig. 1, thus sending impulses over the line as selected by the arrangement of the perforations. The tape moves through the transmitter with a step-by-step movement. Each transmitter is connected to its own ring quadrant of a distributor. As shown in one of the photographs, the distributor is provided with a series of rings which we cannot attempt to explain in detail in this short article. Suffice it to say that this distributor combines the rings of both the receiving and transmitting stations. Of course, the signal sent will operate only the printer at the distant station and not the one shown in the photograph, for this is operated by the transmitter of the distant station.

It will be realized that, in order to prevent overlapping of signals, the contact arms of the distributors at the two stations must run at exactly the same speed and in perfect unison. Otherwise, an impulse sent on segment 3 of station *Y* might be received on 4' or 2' of station *X*, if the contact arm *E'* were running fast or slow. In order to maintain absolute synchronism, an automatic controller is employed, which is located directly behind the tape-operated transmitter. This apparatus is shown, with cover removed, in one of our photographs. The motors are of the phonic-wheel type driven by the impulses of an electrically driven tuning fork. The latter may be seen at the top and rear of the photograph. By means of this system a very accurate control of speed may be obtained. However, the arrangement is such that one motor will rotate a little faster than the other, and when it has gained a certain predetermined angle it is set back by automatic means. This apparatus is also arranged to stop the transmitter if the operator is unable to keep pace with the distributor. Ordinarily, the tape forms a loop between the keyboard mechanism and the transmitter, and into this loop projects a lever from the automatic controller. When the transmitter operates fast enough to pick up all this slack, the tape raises the lever of the controller, which serves to check the action of the transmitter, delaying it until the operator has accumulated enough slack in the tape to release the lever of the controller.

(Concluded on page 440.)



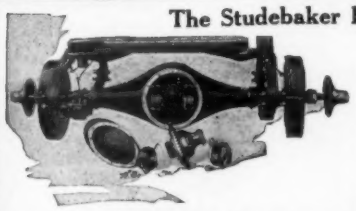


The Studebaker Motor

is the long-stroke, high-speed type—powerful and silent in operation—simple in design and extremely accessible in every one of its details. Remarkably economical of fuel owing to improved design of gas passages, valve openings and manifold.

The Studebaker Springs

together with the remarkable balance of the chassis have made this FOUR one of the EASIEST-riding cars on the road. Long, flat wide, TRIPLE-life springs of Studebaker steel—semi-elliptic in front, full-elliptic underslung in rear. Spring-shackles at both ends to take up end-play—lipped construction and nickel-plated grease cups in joints.



The Studebaker FULL-floating Rear Axle

is not merely a "floating" type of axle—but a real FULL-floating rear axle in which the axle housing carries the weight of the car. TWO Timken Bearings in each hub take up the side-thrust and the shaft itself is left free merely to turn the wheels. It is the SAFEST and most accessible type of rear axle. Studebaker designed and Studebaker built.

What $985 will buy —because it's a Studebaker

At the first glimpse you get of this Studebaker **FOUR** you'll begin to appreciate the evident **QUALITY** that Studebaker has built into its every detail, simply "—because it's a Studebaker."

For you'll find it one of the handsomest cars you ever saw. A car of distinctive design—refined and graceful in line with a rare elegance of finish that few cars at any price can match.

And you'll notice, too, the roominess of this attractive car—and the handsome **CROWN** fenders and the wide doors with hidden hinges and catches, and deep, restful cushions finished with high-grade, hand-buffed leather. And a hundred other little details that lend beauty and grace to its looks.

But it is only when you study the mechanical construction of the car itself that you realize how much you can buy in this car at $985—how needless it is to pay more for a **FOUR**—and how unwise, too, it may be to pay less and sacrifice quality—**QUALITY** you must have, and this is the **ONE** car that can fully satisfy you on every quality point at a price below one thousand dollars.

The rear axle, for example—it's not merely a "floating" type. This **FOUR** has a **FULL**-floating rear axle. It's the most expensive form of axle—but it's the safest and the easiest to get at.

You'll find that instead of following the less expensive construction of driving thro' springs, Studebaker uses TWO radius rods and a torque arm for the drive. The springs are free to take up the jolts and jars—and nothing else.

You'll find brakes of ample size to insure safety at all times on any roads. And a brake-equalizer of the highest type.

You'll find a silent and flexible motor that gives road-mastering power and yet is marvelously economical.

You'll find Timken bearings at every point of **HARDEST** wear—13 of them in all. Is there any other car at less than a thousand dollars that can give you as many?

You'll find a Studebaker-developed Electric System that never fails. And so in every detail you'll find the **QUALITY** that Studebaker must put into the Studebaker **FOUR** "—because it's a Studebaker."

But see this car—stand it side by side with other **FOURS**—no matter what the price. And judge its quality and what it gives, and then, when you know that you can get all this at $985—backed by the $45,000,000 guarantee of that name of Studebaker—you'll begin to realize that Studebaker **QUALITY** is not merely an empty phrase.

STUDEBAKER — Detroit

Canadian Plants: Walkerville, Ont.

Studebaker Features Electric Lighting and Starting—FULL-Floating Rear Axle—Timken Bearings—Safety Tread Rear Tires—One-man Type Top.

	Price in U. S. A.	Price in Canada
Studebaker ROADSTER, - - -	**$985**	$1250
Studebaker LIGHT SIX, - - -	**1385**	1750
Studebaker SIX (7-passenger),	**1450**	1825

The Second-hand Automobile

(Concluded from page 435.)

all kinds of sharpening on his little car, picked up for a song and built over by his own hands. An inventor has constructed a heavy tractor from an old but powerful car, which serves as a model from which his standard tractor will be manufactured. A dye establishment operates a cheap second-hand car with a striking body, for delivery and advertising purposes. Ranchers have found the medium power used car available for heavy work, such as plowing and threshing, when used in connection with a gear-reducing device. One car of foreign make, built in 1902 and brought to Colorado in 1903, is still doing useful work, but now as a plow instead of a pleasure vehicle.

In fact, it seems as if the second-hand car is a very valuable aid to modern business in supplying a great deal of power for a very small amount of cash.

A System of Long Distance Typewriting

(Concluded from page 438.)

At one side of the automatic controller may be seen a sector provided with finger-holes marked "plant," "stop," "repunch," etc. This permits of sending bell signals over the line by pulling the sector against a finger stop and then releasing it.

The printing mechanism is shown in one of the photographs with cover removed. Needless to say it is too complicated to be described in a few words. We can merely refer to some of the parts indicated by the reference numerals. The typewheel and ink rollers are shown at 1, the selecting disks at 2, and the motor at 3. The mechanism that moves the carriage and the paper in front of the typewheel is shown at 4, while 5 is the printing unit, 6 the paper carriage, and 7 the paper-lift magnet unit.

The average speed of telegraphy with the Morse system is about 25 words per minute. With the Murray system, 80 to 90 words per minute each way have been transmitted, that is, 170 words per minute. With the new combined Baudot and Murray system each operator can send on an average 45 words per minute, and as there are four operators sending from each station, we have a total of 360 words per minute on a single line as the average of the new system.

The Psychology of Batting in Baseball

By Arthur Macdonald

WHILE witnessing recent games, I asked myself what was the most obvious general defect. It seemed to be the batting, and especially the knocking of high flies which are almost always caught. The pitching, base running, and fielding seemed to be much better done than the batting.

The value of heavy hitting cannot be overestimated. Some of the types of batters are those who hit anything and everything all the time, like Delehanty, who made four home runs and a single in five times at bat in one game.

There are a few, like "Home Run Baker," who do not make a long sweep at the ball, but hit with a short, sharp stroke, the force of which is increased by movement of shoulders, forearm, and body, as well as strength of wrists. Players of this type have a good chance of hitting the ball about the time it begins to curve, and so are surer batters.

Then there are the so-called "sluggers," who make a long sweep of the bat backward and forward again, but usually not in time to strike the ball squarely, and so are often very uncertain as to the outcome.

About thirty years ago, I used to organize in summer vacations an amateur team who played the game as long and with as much enthusiasm and earnestness as it is done to-day. The principles of the game have not changed, but there have been, of course, variations and changes in the rules. I was in the habit of knocking up for the boys in practice what were called very high flies, and this habit had become so fixed that when I went to the bat I was almost sure to knock a fly, and

INQUIRY COLUMN

READ THIS COLUMN CAREFULLY. You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. There is no charge for this service. *In every case it is necessary to give the number of the inquiry.* Where manufacturers do not respond promptly the inquiry *may* be repeated.

MUNN & CO., INC.

Inquiry No. 9426. Wanted the name and address of a manufacturer who can make ⅝" buoyant balls made into perfect spheres in large quantities. They are intended to take the place of cork. Possible wood pulp might be used.

Inquiry No. 9427. Wanted to secure patented device which is practical, not too expensive, and for which there is a real demand.

Inquiry No. 9428. Wanted to secure an interest in a manufacturing concern. Will buy part or entire interest. Must be a going concern.

Inquiry No. 9429. Wanted the name and address of a manufacturer of a machine for bleaching beeswax.

Inquiry No. 9430. Wanted the name and address of a manufacturer who can supply machinery for producing soluble coffee.

Inquiry No. 9431. Wanted to purchase a mold for shaping and piercing beads made of rose leaf of the consistency of dough.

Inquiry No. 9432. Wanted the name and address of a manufacturer of watch glasses 9 inches in diameter.

Inquiry No. 9433. Wanted the name and address of a manufacturer of a material such as is used by gas mantle makers. The material is used to cover the wire frame that supports the mantle at the top and is used to protect the wire from the flame or heat of the mantle.

Inquiry No. 9434. Wanted the name and address of a manufacturer of special pins, 1/16 of an inch in diameter and ¾ of an inch long, the pins to be made of bone.

Inquiry No. 9435. Wanted the name and address of a manufacturer who can furnish grinding machines for the hollow grinding and finishing of razors. Up-to-date machines wanted.

Inquiry No. 9436. Wanted the name and address of a manufacturer of rat traps having a receptacle attached into which the rat drops and drowns.

Inquiry No. 9437. Wanted the name and address of a concern that can make an oil or grease gun. West preferred. Must be able to make in quantities of 10,000.

Inquiry No. 9438. Wanted the name and address of a manufacturer of light aluminium sheets, small tubing, rods and wire, also aluminium solder.

Inquiry No. 9439. Wanted the name and address of a manufacturer of a knitting machine which was on the market some years ago. The name of the machine was the Bickford Machine. It was a hand knitting machine, weighing about 15 pounds.

Inquiry No. 9440. Wanted the name and address of a concern selling Dr. Young's E-Z Sanitary Belt.

Inquiry No. 9442. Wanted the name and address of a manufacturer of a machine for cutting skeins of cotton and wrapping each bundle around the middle with wire. A machine of some such kind is used in the brush trade for wiring and cutting to length the bundles of bristles for paint brushes.

Inquiry No. 9443. Wanted the name and address of manufacturers of fuel oil burners and fire wall equipment, suitable for a maximum quantity of water evaporation in a locomotive firebox of the following dimensions: 2½' between door and flue sheet, 3' between grate level and crown sheet, 3' between side walls.

Inquiry No. 9444. Wanted the name and address of a manufacturer or patentee of a glass preserving jar made for use with air pumps for creating a vacuum.

Inquiry No. 9445. Wanted the name and address of a manufacturer who can make a combination pencil holder and point protector.

often get out; and the only compensation for this weakness was an occasional home run. So I made it a rule that no member of the team should ever throw up and knock flies for another player, but always try, both in practice and games, to knock grounders, when no base runner need wait, as in flies. The main point is that every time we swing the bat upward, or in such a way as to hit flies, we tend to form a bad habit. But if we always strive to strike downward, or in such a way as to knock grounders, we will tend to form what seems to me the best possible batting habit.

While, of course, there may be conditions where grounders might not be the best play, yet it is unwise for the sake of a temporary advantage to weaken in the least the good habit of muscular movements that tend to knock grounders, the most difficult balls to handle, and which are often fumbled, especially when the men are a little nervous or excited. Fumbles under such conditions frequently lead to bad throws to bases, which are liable to pass the baseman and cause disastrous results.

In discussing with a prominent trainer the question of batting, he said the difficulty was in following any rule on account of the unexpected various curves and drop balls. But this is no answer to a fact of muscular memory, that a fixed habit of such movements of the arm, wrist, and body as tend to knock grounders will also tend to lessen the number of flies. It is not meant that this or any rule should be followed absolutely, for there may be players with idiosyncrasies where a rule should be modified.

Batting Makes Games More Interesting.—Batting is called the blood of the game, and when it is poor, it is like a boxing match where the defense is so much better than the offense, that not a blow is landed.

If baseball is in the future to be successful as in the past, the games must be made as interesting as possible to the spectator. One way to do this is to make the batting more effective. There is nothing that thrills the spectators more than to hear the loud sound of the ball on the bat; they often rise to see where the ball is going. No matter how strong the habit of knocking grounders may be, flies will occur, but they are more liable to be long ones or liners and lead to a home run, which is always exciting. When a high fly is hit there is little interest manifested, as it is assumed, and almost always correctly, that it will surely be caught.

Keeping down the scores to small figures seems to have become a fetish, as high figures are supposed to indicate poor playing. If the batting be improved, the scores may be larger, but this would not necessarily mean that the game was a poor one. On the contrary, there can be better fielding and better batting at the same time, making a lively game and affording more opportunities for brilliant fielding. There might be more errors, but this does not indicate at all that the fielding was poor, but that it was more difficult because of better batting.

Some Causes of Weak Batting.—Specialization is one of the main causes of weakness in batting. Many years ago a first baseman or catcher, who could not bat, was not wanted. In addition, special study is given to the batter's habits at the plate, as to what kind of ball troubles him and where he is liable to hit. The foul strike also gives the batter less chance, and larger gloves than necessary for protection (their original purpose) have increased the fielder's opportunities against the batter.

Individual Bats for the Teams.—Batting now is for the sake of team work, to advance runners and score, rather than make base hits. Often a batter must permit just the kind of ball he can hit to go by, and then strike at one he is lucky even to touch. He may be ordered to wait and let the pitcher weary himself. Some batters can put off fouls and help to tire the pitcher out. If by waiting a batter can get three balls, foul off three, and then strike out, he may aid the team more than if he had made a base hit off the first ball

pitched. For a pitcher pitches about 125 balls in a nine-inning game, and every additional ball may weary him. Rallies in the ninth inning are often the result of waiting by batters who struck out during the former part of the game.

Other batters try to get hit by the pitcher. In most cases any contortion of the arms is so construed, especially by the home crowd. Some push their knees out toward the ball. A batter once stuffed his shirt out six inches and inflated his trousers to give more surface to be hit.

In order to counteract many of his disadvantages, the batter should watch the pitcher and study him carefully, and keep his mind off the bleachers. If he has a slump in his batting, it is generally due to bad physical or mental condition, when he is liable to swing too soon or too late. In practice he should have a pitcher serve him straight swift balls at first until he can get his batting eye back. It has been suggested that one way to help batting might be to enlarge the foul lines a little.

When a great batter is slumping, he may knock the ball just as hard and often, but not in a safe place. But some experts regard place-hitting more or less a matter of chance. At times one is often contented to be able to hit the pitcher at all. Batting is harder to do than fielding. Everybody has a chance to bat, yet there are many more good fielders than good batters. A team of good batters is likely to win the last games of a series, as they come to understand the pitchers better.

Difficulty to Teach Batting.—It is very difficult to teach a man to bat. He must have the eye to tell what the ball will be. A fast ball, breaking close, will not make its jump until about four feet from the plate. Four feet is one fifteenth of the distance from pitcher to batter. A fast ball travels 68 feet in seven eighths of a second, allowing an eighth of a second for the wind-up, so the batter has six eighths of a second, or less, to decide whether or not a pitched ball is going to come over the plate, whether or not it is going to come in or out, up or down, and whether he had better strike or wait.—From *American Physical Education Review.*

Good Roads Legislation

TO aid legislatures in revising road laws and framing new road legislation, a series of papers dealing exhaustively with existing road laws in each State will be issued under an arrangement made by the Legislative Committee of the American Highway Association with the Bureau of Municipal Research of New York city. The complete compilation of road laws already thoroughly indexed and brought up-to-date has been submitted by the committee to A. N. Johnson, Highway Engineer of the Bureau of Muncipal Research, for use in the preparation of a series of papers and charts which will indicate the laws in each State which are conflicting, obsolete, vague or superfluous, and the lines along which simplicity and efficiency in revision may be obtained. Included in the publications to be issued will be suggested models for laws covering State aid to road improvement; the use of convict labor; the issuing of bonds for road construction; the management of local roads; the regulation of traffic, and other related subjects of legislation. Charts illustrating graphically the points of similarity and dissimilarity in the respective State systems will also be prepared.

The American Highway Association, through its Legislative Committee, first secured the effective aid of the United States Office of Public Roads in compiling all road laws and the work which will now be done by the Bureau of Municipal Research is a further step in turning this great fund of information to best advantage. The third step in this important undertaking will comprise personal conferences and hearings in connection with State legislative programmes by experts whose services will be arranged for by the Highway Association. In its field propaganda work the association is represented by Charles P. Light, field secretary, and its office headquarters work in Washington is in charge of I. S. Pennybacker, executive secretary.

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Since these illustrations appeared in the Scientific American advertisement, February 27th, it has been necessary to remake this plate because 111 trucks have been added to above fleets

NOTE—In last 10 days 29 additional White trucks have been delivered, thus making total 140 in place of 111

New York	Broadway at 62nd Street	Pittsburgh	Craig Street and Baum Boulevard	Seattle	1514 Third Avenue
Chicago	2635-2645 Wabash Avenue	Atlanta	63-65 Ivy Street	Memphis	278-280 Monroe Avenue
Philadelphia	216-220 North Broad Street	St. Louis	3422 Lindell Boulevard	Dallas	2025-2027 Commerce Street
Boston	930 Commonwealth Avenue	Washington	1233 20th Street, N.W.	Toronto	14 Alexander Street
San Francisco	Market Street and Van Ness Ave.	New Orleans	750 St. Charles Avenue	Montreal	Forum Building
Baltimore	Mt. Royal and Guilford Avenues	Newark	33-35 William Street	Winnipeg	230 Fort Street